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Studies in the Botany of the Southeastern United States.—XII.

By John K. Small.

(Plate 315.)

I. Noteworthy Species.

Tradescantia montana Shuttl.; Britton, in Britton & Brown, Ill. Fl. 1: 377. *fig.* 911. 1896.

Mr. C. D. Beadle has distributed specimens of this Alleghenian *Tradescantia* from the Biltmore Herbarium, which match the original specimens of Rugel more closely than any others that I have seen. The plants from Biltmore are somewhat larger and more advanced than the specimens on which the species was founded but come from the same general region. The original specimens are accompanied by the following record: "In pre-eruptis reg. med. mont. Broad River Ms., Carolina Sept. legit Rugel, Jun. 1841.

Sisyrinchium graminoides Bicknell, Bull. Torr. Club, 23: 133. 1896.

After describing this *Sisyrinchium* Mr. Bicknell gives a general distribution for the species, but notes the "exact distribution not well made out." I can now record two definite southern stations: the first, Stone Mountain, Georgia, where I collected the plant at an altitude of about 550 meters, in 1895, and Auburn, Alabama, where Prof. Underwood gathered specimens in 1896.

Oxalis grandis Small, Bull. Torr. Club, 21: 474. 1894.

Mr. C. D. Beadle has lately sent me specimens of this, our

most robust species of *Oxalis*, from the Biltmore herbarium, collected in thickets at Biltmore, North Carolina. This collection extends the geographic range of the species somewhat further southward than was heretofore known.

OXALIS RECURVA Ell. Bot. S. C. & Ga. 1: 526. 1821.

As the exploration of the Southern States progresses, Elliott's beautiful and delicate recurved-styled *Oxalis* is being found at various points. Mr. Beadle has sent me ample specimens, showing the extensive rootstock system, and the first specimens gathered bearing mature fruit. The species grows in woodlands at Biltmore.

HEDERA HELIX L. Sp. Pl. 202. 1753.

The common European ivy must be admitted to the flora of the Southern States as an introduced species. It is frequent about old dwellings and similar places and I have found it perfectly naturalized on the steep, rocky banks of the Ocmulgee River, above Macon, Georgia, where it has escaped from a cemetery higher up on the hill.

LIMONIUM AUGUSTATUM (A. Gray).

Statice Brasiliense var. *augustata* A. Gray, Syn. Fl. 2: part 1, 54. 1878.

Perennial, slender, acaulescent; leaves basal, few, the blades linear, 4–7 cm. long, cuspidate, 1-nerved, narrowed into petioles which are somewhat shorter than the blades, their bases dilated; scapes erect, about 3 dm. tall, with several scale-like clasping bracts, sparingly branched above; bracts subtending the flowers broadly oblong, 4 mm. long, acute; calyx about 5 mm. long, the tube glabrous, the 5 teeth ovate, the connecting membranes eroded.

In salt marshes, Pine Key, Florida.

The best treatment of our North American *Limonia* that has thus far appeared is that by Dr. Gray in his Synoptical Flora, 2: Part 1, 54; but one distinct species was there admitted as a variety and one was overlooked. (See page 491.)

The plant just described is apparently rare and I call attention to it hoping that some of the botanists of southern Florida may be able to find it and collect specimens. Heretofore it has been made a variety of *Limonium Brasiliense* (Boiss.) (*Statice Brasiliensis*

Boiss.), but is readily distinguished by its more slender habit, the linear leaf-blades, the oblong acute bracts which subtend the flowers, and the ovate calyx-segments.

GENTIANA QUINQUEFOLIA L. Sp. Pl. 230. 1753.

Mr. A. M. Huger has sent me specimens of this gentian from the vicinity of Waynesville, North Carolina, noting that the plants often produce a prodigious number of flowers, he having counted over three hundred and sixty on some specimens. He has also observed the extensive altitudinal range of the species, recording that it grows from the "bottoms" to "balds," in this case from about 300 meters to nearly 1500 meters. I have noticed the same occurrence in northern Georgia.

IPOMOEA BARBIGERA Sweet, Brit. Fl. Gard. *pl. 86.* 1818.

Dr. Mohr has lately published an interesting note on this species in this journal;* the plant has apparently not been collected many times since its discovery and it would be desirable to know more of its geographic range. Prof. Carl F. Baker has sent me specimens collected near Auburn, Alabama, in the fall of 1896.

IPOMOEA PURPUREA (L.) Roth, Bot. Abh. 27. 1787.

Prof. Baker has also sent me this morning glory, collected near Auburn, Alabama, thus giving us a station between the Atlantic States and Texas; this break in its range is indicated in the Synoptical Flora.†

MENTHA ROTUNDIFOLIA (L.) Huds. Fl. Angl. 221. 1762.

Only one station in the Southern States, namely, "near Wilmington, North Carolina,"‡ has been recorded for this mint. However the species is spreading; in 1891 Miss K. A. Taylor collected specimens in a wet meadow near Columbia, South Carolina, and in 1895 I found it abundant near Trader's Hill in southeastern Georgia.

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* Bull. Torr. Club, 24: 26.

† Syn. Fl. N. A. 2: 210.

‡ Chapm. Fl. S. St. Ed. 2. 313.

TEUCRIUM NASHII Kearney, Bull. Torr. Club, 21: 483. 1894.

Mr. A. H. Curtiss has added another station for *Teucrium Nashii*. The specimens are from near Jacksonville, Florida, and are numbered 5040.

LONICERA JAPONICA Thunb. Fl. Jap. 89. 1784.

In a former note* I have spoken of the abundance of this foreign plant in certain localities. Mr. A. H. Curtiss now sends it from Florida (number 4690) saying, "In moist thickets where this gets a foothold it grows and fruits more freely than does *L. sempervirens* on dry land. I do not know that either grow from seed." I may add that it has become a very troublesome weed in many parts of the country.

II. NEW SPECIES.

VICIA HUGERI.

Annual, very slender, bright green, minutely and sparsely pubescent, or glabrate in age. Stems ascending, decumbent or reclining, solitary or several together, 3–7 dm. long, wire-like, more or less angled, sometimes branched above, rarely branched below; leaves 4–8 cm. long, the tendril simple or forked; leaflets usually 10–12, linear, 2–3.5 cm. long, mucronulate, straight or slightly curved, short-petioled; peduncles 5–8 cm. long, ascending; flowers white or sometimes pinkish, 10–14 in secund racemes, small; pedicels 1.5–2 mm. long; calyx campanulate, 1.5 mm. long, the teeth triangular, ¼–⅓ as long as the tube, acute; corolla about 5 mm. long; pods linear-oblong, 2 cm. long.

In open woods, Georgia and Alabama. March to May.

Lately several specimens of this peculiar species of *Vicia* have reached me from different points in the Southern States. The plant first came to my notice on the slopes of Stone Mountain, Georgia, in 1895. The species stands between *Vicia Caroliniana* and *V. micrantha*, possessing the general habit of the latter and the inflorescence of the former.

From *Vicia micantha* it differs in its elongated many-flowered racemes, longer peduncles and glabrous or glabrate calyx with the segments as broad as long or broader, while from *Vicia Carolinana* it can easily be distinguished by its more slender habit,

* Bull. Torr. Club.

narrower leaves and the smaller flowers, these being hardly one-half as large as those of *Vicia Caroliniana*. I take pleasure in naming the species for my friend Mr. A. M. Huger, a very thorough explorer of the flora of the Southern States. I have specimens before me as follows:

Georgia: Stone Mountain, May 1–18, 1895, J. K. Small; Americus, March 1, 1897; Atlanta, April, 1897, and Gainesville, April, 1897, A. M. Huger.

Alabama: Auburn, March 28 and April 18, 1896, L. M. Underwood and F. S. Earle.

SAMOLUS CUNEATUS.

Perennial, fleshy. Stems solitary or tufted, 1–3 dm. long, ascending or reclining, simple or usually branched; leaves opposite or mainly so, obdeltoid-spatulate or broadly spatulate, 4–12 cm. long, truncate or coarsely mucronate at the apex, the bases decurrent as broad wings; racemes 1–3 dm. long, their peduncles longer than the stems, together with the racemes glandular-pilose; pedicels slender, spreading or ascending, 1–3 cm. long; calyx campanulate, the triangular acute segments longer than the tube, or at maturity shorter; corolla white, 4–5 mm. broad, the 5 lobes broadly cuneate, flattish or truncate at the apex, toothed, as long as the tube; stamens included; capsules depressed-globose, 3–3.5 mm. in diameter; seeds .4 mm. thick.

On limestone rocks or soil, Texas. Spring.

A study of the genus *Samolus* has revealed this hitherto undescribed species; it is related to *Samolus alyssoides* and *S. ebracteatus*, from both of which it may be distinguished by the glandular-pilose peduncles and smaller corollas. The corollas of specimens of *Samolus alyssoides* and *S. ebracteatus* which I have examined vary from 6–9 mm. in breadth, while those of *S. cuneatus* are only 4–5 mm. broad. The corolla-segments of the new species are broadly cuneate as contrasted with the suborbicular segments of the two older ones.

The following specimens belong to *S. cuneatus:*

Texas: Kerrville, Kerr county, May 14–21, 1894, A. A. Heller, no. 1751 (type); Waco, 1887, Miss Sara Trimble.

LIMONIUM NASHII.

Perennial by branching rootstocks, glabrous. Leaves basal, the blades oblong or elliptic, sometimes varying to narrowly

obovate, 4–10 cm. long, rounded or notched at the apex, occasionally mucronate, narrowed into petioles which are shorter than the blades or longer; scapes erect, 3–7 dm. tall, furnished with scale-like bracts, widely branching above, the tips of the spreading branches recurved; bracts subtending the flowers oval, about 4 mm. long, obtuse; calyx 6–7 mm. long, the tube sparingly pubescent with soft hairs at the base only, the 5 segments triangular, slightly acuminate, more than 1 mm. long; corolla deep blue.

In salt marshes, Florida. Summer and fall.

Specimens of a beautiful and previously undescribed species of *Limonium* have been in our herbaria for some years; they are from northern and eastern Florida and represent a species of more slender and more graceful habit than that of *Limonium Carolinianum*.

The following synopsis and comparison of the diagnostic characters of *Limonium Nashii* and *L. Carolinianum* will serve to make clear the difference between the two species:

Limonium Nashii. Branches of the panicle spreading, the tips recurved; bracts subtending the flowers oval; calyx-tube sparingly pubescent at the base; calyx-segments triangular, slightly acuminate.

Limonium Carolinianum. Branches of the panicle ascending, the tips curved upward; bracts subtending the flowers suborbicular; calyx-tube bristly-pubescent; calyx-segments ovate.

The species has been collected as follows:

Florida: Chapman; St. Marks, Aug. 1843, Rugel; Titusville, Brevard County, July 31, 1895, Nash. no. 2305.

EUPATORIUM PETALODIUM Britton.

Perennial, bright green. Stems erect, 3–7 dm. tall, simple below, corymbosely branched above, somewhat rough with rigid hairs; leaves mainly opposite (a few of the upper ones alternate), oblong to lanceolate, 2–8 cm. long, obtuse or rarely acutish, bluntly serrate or crenate-serrate, except the entire more or less cuneate base, glabrous or sparingly pubescent on the nerves beneath, sessile; peduncles and pedicels pilose; involucres trumpet-shaped, 9–10 mm. high, the bracts linear-spatulate, the outer ones abruptly acuminate, the inner ones mucronate, slightly surpassing the flowers, petal-like, white; corolla 3 mm. long, the segments ovate, spreading; pappus about equalling the corolla; styles exserted; achenes black, nearly 3 mm. long, 5-angled.

In dry pine barrens, Florida. Summer and fall.

Florida: Chapman; Duval County, N. E. Florida, Curtiss, no. 1190; near Jacksonville, Curtiss, nos. 4437 and 5162.

A showy species hitherto confused with *Eupatorium album* and not yet found without the State of Florida. The general habit of the species is that of its nearest relative, *E. album*, but in place of an acute leaf-blade there is an obtuse apex. However, the crucial character lies in the inner involucral bracts; these, instead of being long-acuminate, are linear-spatulate and conspicuously mucronate, the dilated portions of a white or creamy-white color.

Chrysopsis Ruthii.

Perennial, slender, silvery-pubescent, stoloniferous. Stems diffusely branched, 1–3 dm. long, the branches ascending or decumbent, very leafy, densely so above; leaves linear or some linear-lanceolate, 2–5 cm. long, acuminate, entire, sessile, the old ones becoming longitudinally ribbed; heads solitary, or corymbosely disposed, about 1 cm. high; peduncles 1.5–2 cm. long, densely glandular; involucral bracts linear or linear-lanceolate, in 4–5 series, glandular on the back, the pale edges ciliate, the apex bearded; rays bright yellow, elliptic-spatulate, 7–8 mm. long, slightly notched at the apex; corolla 5 mm. long, yellow, the segments triangular, sparingly ciliate, nearly erect; pappus dirty white, slightly shorter than the corolla; filaments and anthers glabrous; style glabrous, except the very sparingly glandular top; achenes pubescent.

Rocks in the Hiawassee Valley, eastern Tennessee.

A low stoloniferous species related to *Chrysopsis graminifolia* from which it differs conspicuously in being low, diffusely branched and bushy. Besides the very slender habit, the small acuminate leaves, the glandular peduncles and narrower and more acuminate involucral bracts distinguish *Chrysopsis Ruthii* from *C. graminifolia*. The species is named for Prof. A. Ruth, of Knoxville, Tenn.

Silphium Mohrii.

Perennial, coarse, very hispid throughout with shaggy hairs. Stem erect, 6–12 dm. tall, simple below, branched above, finely channelled in age; leaves alternate, ovate-lanceolate to narrowly ovate, 5–14 cm. long, acuminate, remotely serrate with prominent teeth, except near the base and apex, sessile or nearly so; heads 3.5–4.5 cm. broad, peduncled; involucres broadly campanulate, the bracts lanceolate or ovate-lanceolate, 8–14 mm. long, acute or somewhat acuminate; corolla about 4 mm. long, the

segments ovate, rather obtuse; rays yellow, elliptic-oblong, 10–14 mm. long, undulately 3-toothed at the apex; achenes obovate, more or less constricted at both ends, about 6 mm. long, winged (Plate 315).

In dry or rocky soil, Cullman, Alabama, October, 1885.

A very distinct species of the confused genus *Silphium*, related to what I take to be *S. asperrimum* Hook., hitherto usually called *S. scaberrimum*. It is at once distinguished by the copious shaggy pubescence of its foliage as against the short retrorse pubescence of its relative. The peculiarly toothed leaves with their less rounded bases, and the smaller heads with their narrower bracts and shorter rays are additional distinguishing characters.

The species is named in honor of the veteran botanist of Alabama, Dr. Charles Mohr, who for many years has furnished our collections with rare and unique plants from that interesting region.

III. The True Position of Viola tripartita Ell.

The record of the occurrence of *Viola hastata* in Florida has always been a puzzle to me, for that plant is as typical an Alleghenian species as our flora affords.

During my field work in the Southern States I have had opportunity to study the forms under consideration in their native habitats and have been led to the following conclusions, namely: That *V. tripartita* is specifically distinct from its relatives, and that it is closely related to *V. pubescens* and *V. scabriuscula* and not to *V. hastata*. It seems strange that Dr. Gray, and even the sagacious Le Conte failed to observe the latter fact, for a casual glance at the foliage and flowers is sufficient to prove this position correct, the sepals and petals of *V. tripartita* being much more similar to those of *V. pubescens* than to those of *V. hastata*.

The question that naturally arises is: How was *V. tripartita* ever confounded with *V. hastata*? As far as I can see this was brought about through observations on simple-leaved plants of *V. tripartita*; it is on simple-leaved specimens of this plant that *V. hastata* is admitted to the flora of Florida. The leaf form of the latter species is so distinct and unique that it need not be further considered in this connection. On the other hand the leaf form of *V. tripartita* in its simple state, which is quite frequent,

closely resembles that of *V. pubescens* but differs in size, shape, proportionate width and length and the toothing. It may be of interest to note that I have seen the type of *V. tripartita* on several occasions and have collected specimens almost identical with it on Stone Mountain, which is no great distance from the original locality, Athens, Georgia. I have also received excellent and typical specimens from Mr. A. M. Huger, collected in Polk County, North Carolina, and a series of specimens showing all degrees of gradation from the simple-leaved state to the trifoliolate leaf, from Mr. E. R. Memminger, who independently came to the conclusion that the affinities of *V. tripartita* are with *V. pubescens* and not with *V. hastata*.

I append a description taken from living plants.

VIOLA TRIPARTITA Ell. Bot. S. C. & Ga. 1: 320. 1817.

Viola hastata var. *tripartita* A. Gray, Bot. Gaz. 11: 291. 1886.

Perennial by a short rootstock and numerous coarse roots, usually stoutish, puberulent or minutely pilose and glandular above, bright but often deep green. Stems mostly clustered, erect, 1.5–5 dm. tall, usually branched above, often purplish and glabrate below, greenish, glandular, and somewhat glandular near the top; leaves 3-parted or sometimes entire, 4–10 cm. long, their petioles 2–3 cm. long; stipules ovate, ciliate, 6–8 mm. long; leaflets usually short-petioled, puberulent, undulate or crenate-serrate, the terminal one lanceolate or oblanceolate, the lateral ones inequilateral lanceolate to ovate; flowers golden yellow, 1.2–1.5 cm. broad; pedicels slender, nearly erect, 3–10 cm. long; sepals lanceolate or oblong-lanceolate, nearly 6 mm. long, 3-ribbed, acute or obtuse, with hyaline ciliolate margins; petals spatulate, about 1 cm. long, the upper ones recurved, purplish on the back, with one conspicuous black vein, the lateral ones with two black veins and a patch of glands, the lower one with numerous conspicuous black veins; stigma bearded; capsule oblong, 1–1.2 cm. long, acutish; seeds pale, obovoid, 3 mm. long.

IV. MELOTHRIA GRANDIFOLIA T. & G., AND ITS TRUE POSITION.

Melothria grandifolia, published by Torrey and Gray in 1840, soon disappeared from the pages of succeeding botanical works and in Prof. Cogniaux's Monograph of the Cucurbitaceae* we find the name in an appended list of doubtful species. The apparent rarity of the species, or at least the scarcity of speci-

* DC. Monog. Phanerog. 3: 948.

mens in herbaria may account for the way in which the plant was excluded from botanical literature by later authors; an examination of the original specimens of the plant in question, however, shows that it is not a *Melothria* in the modern sense and hereafter may be known as

CAYAPONIA GRANDIFOLIA (T. & G.).

Melothria grandifolia T. & G. Fl. N. A. 1: 541. 1840.

The species is closely related to *Cayaponia Boykinii* of the Southern States, but differs in the more robust habit, the larger leaves and in the larger and more elongated fruit.

The Santa Monica Diatomaceous Deposit with List of References to Figures of Species.

BY E. A. SCHULTZE AND C. HENRY KAIN.

Probably no fossil diatomaceous material ever excited greater interest than that from Santa Monica, California. A paper upon the deposit by Mr. Charles Stodder was read before the San Francisco Microscopical Society, December 5, 1878. At that meeting, Mr. Thomas P. Woodward, who found the original piece of material, stated that he discovered it in the tidal refuse left by the waves at high water mark. The locality was about two miles south of a lagoon situated several miles southeast of Santa Monica. He also stated that there were no evidences of any other diatomaceous earth in the vicinity.

A few years since, Mr. F. H. Dunning, of Battle Creek, Michigan, discovered that the true source of the material was at Redonda Beach, some twenty-five or thirty miles south of Santa Monica. At this place the material occurs abundantly in a bluff situated on the beach, and pieces of it which have been broken off by the action of the waves can be picked up at low tide, at the foot of the cliff.

Mr. Silas L. Schumo, of Philadelphia, who has recently visited the locality, states that the diatom cliffs begin about ten miles south of Redondo Beach and extend southward for several miles, at least as far as San Pedro. There is some difficulty in getting at the material, however, as the foot of the cliff is only accessible at low tide. The deposit is so interesting that it is to be hoped microscopists on the Pacific coast will explore it more thoroughly.

Those who have made a study of the matter are aware of the extreme difficulty of tracing out the species through the literature of the Diatomaceae, and will doubtless find of great service the following list of references to the figures of species contained in the famous deposit :

Actinoptychus	*splendens*	Ralfs. V. H., 119, f. 1, 2, 4.
"	*vulgaris*	Schum. V. H., 121, f. 5, 6; var. *Monicae*, 121, f. 9.
"	*undulatus*	Ehr. Atlas, 91, f. 5; *Atlas, 132, f. 16.*
"	*glabratus*	Grun. Atlas, 154, f. 2, 3, 4; V. H., 120, f. 6.
"	*spinifer*	Grun. Atlas, 153, f. 23.
"	*Mölleri*	Grun. *Atlas, 132, f. 14.*
"	*hispidus*	Grun. *V. H., 123, f. 2.*
"	*Stella*	A. S. *Atlas, 90, f. 1, 2.*
"	*Bismarckii*	A. S. Atlas, 91, f. 4.
"	*Gründleri*	A. S. Atlas, 100, f. 3, 4.
"	*Asiaticus*	Temp. & Br. *Atlas, 156, f. 10; Diatoms of Japan, p. 11, 3, f. 9.*
"	*laevigatus*	Grun. *V. H., 122, f. 7; Atlas, 132, f. 15.*
"	*nitidus*	Grev. *Atlas, 1, f. 7.*
"	*Clevei*	A. S. *Atlas, 91. f. 1.*
Aulacodiscus	*Comberi*	Arn. *Atlas, 36, f. 11; 103, f. 5.*
"	*angulatus*	Grev. *Atlas, 34, f. 7, 8; 103, f. 2; 105, f. 7, 8.*
"	*convexus*	Gr. & St. *J. Q. C., Aug. '87, 12, f. 32.*
"	*margaritaceus*	Ralfs. *Atlas, 37, f. 1–8; 92, f. 12; 103, f. 6–9; 105, f. 1.*
"	*amoenus*	Grev. *Atlas, 34, f. 6; 40, f. 13; 134, f. 7; var. sparsi-radiata, 133, f. 4-6.*
"	*pulcher*	Norm. *Pritch, 8, f. 28.*
"	*Oreganus*	Bail. Atlas, 107, f. 7.
"	*Kittoni*	Arn. *Atlas, 36, f. 5–7.*
"	*Huttonii*	Gr. & St. *Atlas, 124, f. 6; 146, f. 8; J. Q. C., Aug., '87, 12, f. 31.*
"	*Crux*	Ehr. *Atlas, 105, f. 5; 124, f. 1.*
"	*Rattrayi*	Gr. & St. *J. Q. C., Aug., '87, 11, f. 29.*
Auliscus	*speciosus*	A. S. Atlas, 108, f. 3; 80, f. 5.
"	*punctatus*	Bail. Atlas, 89, f. 14–17.
"	*Hardmanianus*	Grev. Atlas, 67, f. 1; 89, f. 4; var. Atlas, 108, f. 1.
"	*Biddulphia*	Kitt. Atlas, 67, f. 3; var. Atlas, 89, f. 2.
"	*Stockhardtii* (*A. racemosus* Ralfs)	Jan. Atlas, 67, f. 6.
"	*pruinosus*	Bailey. *Atlas, 31, f. 6; 108, f. 10;* var. *subreticulata* Grun., Atlas, 89, f. 5, 6.
"	*ovalis*	Arn. *Atlas, 30, f. 16, 17.*
"	*mirabilis*	Grev. Atlas, 89, f. 13.
"	*confluens*	Grun. *Atlas, 31, f. 16; 32, f. 6–8.*

Auliscus	*caelatus*	Bail. *Atlas, 32, f. 14, 15.*
"	*sculptus*	Ralfs. *Atlas, 30, f. 8; 32, f. 21, 22; V. H., 117, f, 1.*
Actinocyclus	*subocellatus*	Rattr.
"	*radians*	Rattr.
"	*incertus*	Grun. V. H., 125, f. 4.
"	*Ehrenbergii*	Ralfs. V. H., 125, f. 1; var. *intermedia* Grun. V. H., 124, f. 5.
"	*Ralfsii*	Sm. *V. H., 123, f. 6;* var. *Monicae,* Grun. V. H., 124, f. 3; var. *Janischii* Schum. V. H., 125, f. 1.
"	*fasciculatus*	Cast. *Cast, 4, f. 8.*
"	*subtilis*	Ralfs. *V. H., 124, f. 7.*
Arachnoidiscus	*Indicus*	Ehr. *Atlas, 68, f. 6; vars. Atlas, 68, f. 7–10; 73, f. 2.*
"	*ornatus*	Ehr. *Atlas, 73, f. 4–6; vars. Atlas, 73, f. 7–10.*
"	*Ehrenbergii*	Bail. *Atlas 68, f. 1; vars. 68, f. 2, 3, 4.*
"	*Grevilleanus*	Hardm. *Atlas, 68, f. 5; 73, f. 3.*
Amphora	*crassa*	Greg. *vars. Atlas, 39, f. 30, 31; 28, f. 12; Leus, p. 75, pl. 2, f. 5.*
Asterolampra	*rotula*	Grev. *T. M. S., 1860, p. 120, 3, f. 5;* (*Moebius, 32, f. 5*).
"	*Brebissonii*	Grev. *T. M. S., 1860, p. 114, 3, f. 9;* (*Moebius, 32, f. 9*).
"	*Darwinii*	Grev. *T. M. S., 1860, p. 116, 4, f. 12, 13;* (*Moebius, 33, f. 12, 13*).
"	*variabilis*	Grev. *T. M. S., 1860, 111, 3, f. 68;* (*Moebius, 32, f. 6–8*).
"	*Humboldtii*	Ehr.
"	*Brookei*	Grev. *T. M. S., 1860, p. 119, 4, f. 16;* (*Moebius, 33, f. 18*).
Amphitetras	*Graeffeana*	Witt. *Atlas, 79, f. 1, 9.*
Biddulphia	*multicornis*	Grun. *V. H., 102, f. 7;* var. Atlas, 173, f. 13, 14.
"	*pulchella*	Gray. *V. H., 97, f. 1–3; Atlas, 118, f. 26–32; 120, f. 22; 121, f. 1, 2.*
"	*Tuomeyi*	Bail. Atlas, 119, f. 15.
"	*capucina*	A. S., *Atlas, 113 f, 13, 14.*
"	*polyacantha*	Brun.
"	*aurita*	Breb. *V. H., 98, f. 4–9;* Atlas, *120, f. 5–8; 122, f. 1–9; 122, f. 28.*
"	*longispina*	Grun. V. H., 102, f. 6.
"	*tridentata*	Ehr. Deby, p. 41, pl. 3, f. 21.
"	*Grundlerii*	A. S. *Atlas, 118, f. 22–24.*
Campylodiscus	*adornatus*	A. S. *Atlas, 51, f. 5; 52, f. 3.*
"	*Coronilla*	Brun. Deby, p. 42, pl. xiv., f. 69; also, pl. xiii., f. 66.

Campylodiscus	*concinnus*	Grev. *Atlas, 18, f. 16, 17; 53, f. 9.*
"	*Rabenhorstianus*	Jan. *Atlas, 53, f. 12, 14.*
"	*imperialis*	Grev. *Atlas, 17, f. 20; 15, f. 11; 52, f. 7; 53, f. 6, 7.*
"	*bimarginatus*	A. S. *Atlas, 16, f. 7; 18, f. 15–17.*
"	*Californicus*	(Grove) Deby. Deby, 42, pl. xiv., f. 70.
"	*Pfitzeri*	A. S. *Atlas, 17, f. 5, 6.*
"	*ecclesianus*	Grev. *Atlas, 16, f. 5, 6, 8–11.*
"	*biangulatus*	Grev. *Atlas, 14, f. 18–22*
Campyloneis	*Grevillei*	A. S. *V. H., p. 134, 28, f. 10, 12.*
Coscinodiscus	*elegans*	Grev. *Atlas, 58, f. 7.*
"	*lineatus*	Ehr. *V. H., 131, f. 3; Atlas, 114, f. 13.*
"	*curvatulus*	Grun. *Atlas, 57, f. 30, 33;* var. *latius-striata,* Atlas, 57, f. 34.
"	*obscurus*	A. S. *Atlas, 61, f. 16–18; V. H., 129, f. 4.*
"	*debilis*	Grove. *Atlas, 163, f. 4.*
"	*Asteromphalus*	Ehr. Atlas, 113, f. 23; var. *eximia* (Rattray); Atlas, 63, f. 12.
"	*Odontodiscus*	Grun. *Grun,* Diat. of Franz Joseph Land *1884, p. 29, 3, f. 23.*
"	*Gigas*	Ehr. *Atlas, 64, f. 1.*
"	*robustus*	Grev. *Atlas 62, f. 5, 6, 16, 17.*
"	*apiculatus*	Ehr. *Atlas, 64, f. 5–10;* var. *Monicae* (Rattray), Atlas, 63, f, 10.
"	*pilosus*	A. S. Atlas, 148, f. 8.
"	*polyacanthus*	Grun. *Cleve, 1880. 7, f. 127.*
"	*micans*	A. S. *Atlas, 139, f. 213.*
"	*excentricus*	Ehr. *Atlas, 58, f. 49; V. H., 130, f. 4, 7, 8.*
"	*luctuosus*	Grove. *Atlas, 148, f. 3.*
"	*radiatus*	Ehr. *Atlas, 113, f. 8.*
"	*concavus*	Ehr. *Atlas, 59, f. 16.*
"	*Diorama*	A. S. Atlas, 64, f. 2.
"	*borealis*	Bail. Atlas, 63, f. 11.
"	*tenuis*	Grun.
"	*crassus*	Bail. *Atlas, 61, f. 19.*
Cocconeis	*cruciata*	Pant. *Pant. Vol. 1, 16, f. 148.*
"	*formosa*	Brun. *Atlas, 193, f. 42–47.*
"	*voluta*	Brun. Var. *singularis* A. S.; Atlas, 196, f. 25, 26; var. 196, f. 19.
"	*Oculus-Cati*	Brun. Atlas, 198, f. 29; *Atlas, 198, f. 22, 23.*
"	*costata*	Greg. *V. H., 30, f. 11–17; Atlas, 189, f. 6, 7.*
"	*dirupta*	Greg. *V. H., 29, f. 13–15; Atlas, 197, f. 1, 31.*
"	*regalis*	Grev. *V. H., 28, f. 13, 14; var. 8, 9; M. J., 1889, p. 156, 7, f. 1 = Moebius 21, f. 1.*
"	*pseudo-marginata*	Greg. *Atlas, 194, f. 8; 196, f. 5–8; V. H., 29, f. 20, 21.*

Cocconeis	*interrupta*	Grun. *Atlas, 194, f. 17; V. H., 30, f. 3, 4.*
"	*cyclophora*, var. *Californica*	Brun. *V. H., 30, f. 24, 25; var. Atlas, 198, f. 1–3.*
"	*nitida*	Greg. *G. D. C., p. 20–1, f. 26; V. H., 36, f. 33.*
Cerataulus	*turgidus*	Ehr. *V. H., 104, f. 1, 2; Atlas, 116, f. 1–3; var. Atlas 115, f. 12–14.*
"	*Hungaricus*	Pant. *Pant. Vol. II., 26, f. 375;* (*a variety of C. Thumii*).
"	*Kinkeri*	A. S. Atlas, 191, f. 37.
Climacosphenia		
Craspedodiscus	*coscinodiscus*	*Atlas, 66, f. 3, 4.*
Eupodiscus	*argus*	Ehr. *V. H., 117, f. 3–6; Atlas, 92, f. 7–11.*
"	*oculatus*	Grev. *Atlas, 117, f. 9.*
Eupleuria.		
Euodia	*Janischii*	Grun. V. H., 127, f. 1–4.
"	*gibba*	Bail. *Prit. 852–8, f. 22* (= *Hemidiscus cuneiformis*) *; T. M. S., 1860, p. 42, 2, f. 3, 4* (= *Moebius 31, f. 3, 4*).
Endyctia	*oceanica*	Ehr. *Atlas, 65, f. 10, 13.*
Glyphodesmis	*Williamsonii*	W. Sm. *V. H., 36, f. 14.*
Grayia. Probably *Grayia Argonauta*		Grove and Brun. *Atlas, 172, f, 11.*
Goniothecium	*odontella*	Ehr. *V. H., 105, f. 11, 12; Moebius, 8, f. 47, 48.*
"	*obtusum*	Ehr. *Microgeologie, 18, f. 95.*
"	*Rogersii*	Bail. *Mic. Dict. 42, f. 30; M. J., 1856, 7, f. 43, 46;* (= *Moebius, 8, f. 43, 46*).
Grammatophora	*arctica*	Cl. *V. H., 53, bis f. 3.*
"	*Tabellaris*	Brun.
"	*stricta*	Ehr. *Witt. 1888, p. 16, 3, f. 7, 14; Jeremie, Hayti.*
"	*robusta*	Dippel. *Pant, Vol. I, 30, f. 312, 315, 316.*
"	*maxima*	Grun. *V. H., 53, bis f. 12*
Gephyria	*gigantea*	Grev. *Grev. T. M. S,. 1866, 122, 11, f. 7, 8;* (*Moebius 74, f. 7, 8*)*; Challenger, p. 42, 15, f. 10.*
Glyphodiscus	*stellatus*	Grev. V. H., 118, f. 3. *Atlas, 117, f. 11.*
Hyalodiscus.		
Isthmia	*nervosa*	Kg. *Atlas, 136, f. 5; 135, f. 1–6.*
Lithodesmium	*minusculum*	Grun. *V. H., 116, f. 1–6.*
Melosira	*clavigera*	Grun. *V. H., 91, f. 1, 2; Atlas, 175, f. 21–24.*
"	*radiata*	Bright.
"	*Sol*	Kg. *V. H., 91, f. 7–9.*
"	*sulcata*	Kg. *Atlas, 178, f. 1–4; 7, 8, 9, 16, 17, 18, 19, 22, 23, 24; 25–36;* var.
Mastogonia	*polygona*	Ehr.

Navicula	*Taschenbergi*	A. S. Atlas, 174, f. 8, 9.
"	*sideralis*	Brun. Atlas, 174, f. 3.
"	*pedalis*	Brun. Atlas, 174, f. 15.
"	*Apis*	Ehr. *Atlas, 12, f. 16–25; 69, f. 41, 43, 44; Donkin, p. 48 f. 3.*
"	*interrupta*	Kütz. *Atlas, 12, f. 10, 11; 12, f. 3–7, 8; 45, f. 72. V. H., 9, f. 7. Donkin, p. 47, 7 f. 2.*
"	*Eudoxia*	A. S. *Atlas, 8, f. 39, 40; 70, f. 71.*
"	*elliptica*	Kütz. *Atlas, 7, f. 27–32, 33, 34, 54, 55; V. H., p. 92, 10, f. 10.*
"	*aspera*	Ehr. *Atlas, 48, f. 2–6; var. 48, f. 14, 15.*
"	*pennata*	A. S, *Atlas, 48, f. 41–43.*
"	*praetexta*	Ehr. *Atlas, 129, f. 7; 3, f. 30–32–34; V. H., p. 92, 9, f. 13.*
"	*Angelorum*	*Cleve, Some new and little known Diatoms, p. 8, 2, f. 20.*
"	*Oswaldii*	Jan. *Atlas, 70, f. 46.*
"	*spectabilis*	Grev. *vars-Atlas, 2, f. 31; 3, f. 20, 21, 24; Grun, 1860, p. 533, 1, f. 11* (*N. Grunowii, Atlas, 70, f. 73.*)
"	*Lyra*	Ehr. *Atlas, 2, f. 24, 25, 32; 3, f. 11, 12; V. H., p. 93, 10, f. 1.*
"	*gelida*	Cl. *Diat. Franz Joseph Land, 1, f. 27, 28; Cleve., Vega ex., p. 473, 37, f. 42.*
"	*Hennedyi*	Sm. *Atlas, 3, f. 18; V. H., p. 93, 9, f. 14.*
"	*clavata*	Greg. *Donkin, 2, f. 8; Greg., M. J., 1888, p. 46, 5, f. 17;* (*Moebius, pl. 10, f. 17.*)
"	*Basilica*	Brun.
"	*Dirrhombus*	A. S. *Atlas, 11, f. 21, 22; 69, f. 9.*
"	*gemmata*	Grev. *Var. spectabilis, Atlas, 8, f. 38* (*N. Grunowii*); *Grev, New species of Naviculae in Californian Guano, p. 30, 4, f. 7.*
"	*ornata*	A. S. *Atlas, 69, f. 5.*
"	*splendida*	Greg. *Atlas, 12, f. 31–35; 13, f. 31–34; 69, f. 22.*
"	*Crabro*	Ehr. Var. Atlas, 69, f. 2; *vars. Atlas, 69, f. 3, 4; V. H., 9, f. 1, 2; Atlas, 129, f. 17, 18.*
"	*robusta*	Grun. *Atlas, 50, f. 1, 2.*
"	*Californica*	Grev. *Vars. Atlas, 3, f. 15, 16, 19; 3, f. 6.*
"	*forcipata*	Grev. *Atlas, 70, f. 17; V. H., p. 94, 10, f. 3.*
Nitzschia	*Formica*	Hantzsch. *Diat. of East Indian Archipelago, p. 21, 2, f. 8.*
Orthoneis	*splendida*	Grun. *V. H., 28, f. 1, 2.*
Peponia	*Barbadensis*	Grev. *Atlas, 144, f. 48, 49.*
Porpeia	*quadrata*	Grev. V. H., 95, bis f. 15.
"	*quadriceps*	Bail. *Atlas, 142, f. 46–57*; (*Moebius, 68, f. 13*); *T. M. S., 1865, p. 52, 6, f. 18, 19.*

Porpeia	*ornata*	Grev. *T. M. S., 1865, p. 53, 6, f. 21.*
Pantocsekia		
Podosira.		
Pleurosigma	*affine*	Grun. *V. H., p. 115, 18, f. 9.*
Pyxilla	*Americana*	Grun. V. H., 83, bis f. 3.
"	*dubia*	Grun. *V. H., 83, f. 7, 8.*
Plagiogramma	*pulchellum*	Grev. *M. J., 1859, p. 209, 10, f. 4, 6 (‖ Moebius, 24, f. 4, 6); Prit., p. 774, 4, f, 32.*
Raphoneis	*Rhombus*	Ehr. *M. J., 1854, 6, f. 10 (= Moebius, 4, f. 10); Microgeologie, 18, f. 84, 85; 33, 13, f. 15; 35, A, 11, f. 3.*
Rutilaria	*hexagona*	Grun. V. H., 105, f. 8; Atlas, 183, f. 17.
"	*longiformis*	Temp. & Br.*
Rhabdonema	*Adriaticum*	Kg. *V. H., 166, 54, f. 11, 13.*
"	*Japonicum*	Temp. & Br. *p. 53, 1, f. 6; Diat. Japan.*
"	*valdelatum*	Temp. & Br. *p. 53, 1, f. 4; Diat. Japan.*
Stauroneis	*pulchella*	Sm. = *Nav. aspera, which see.*
Synedra	*superba*	Kg. *O'Meara, p. 199, 28, f. 9; S. B. D., 12, f. 102.*
"	*longissima*	Smith. *O'Meara, p. 307, 28, f. 27; S. B. D., p. 72, 12, f. 95.*
Stephanopyxis	*appendiculata*	Ehr. *Several varieties; Atlas, pl. 130.*
"	*rudis*	Grev. Atlas, 164, f. 9.
"	*Grunowii*	G. & St. *Atlas, 130, f. 1, 5.*
"	*Weissflogii*	A. S. *Atlas, 123, f. 2.*
"	*Corona*	Grun. Atlas, 123, f. 19, 20.
Stictodiscus	*Californicus*	Grev. *Atlas, 74, f. 4, 5; vars. pl. 74; pl. 147, f. 10.*
"	*nitidus*	G. & St. *Atlas, 131, f. 7, 8.*
"	*Kittonianus*	Grev. *Atlas, 74, f. 16, 18; 131, f. 4.*
Systephania	*Corona*	Ehr. *See Stephanopyxis corona.*
Skeletonema.		
Stephanogonia	*actinoptychus*	Ehr. *V. H., 83, ter f. 2, f. 4; = Mastogonia actinoptychus*
Triceratium	*formosum*	Bright. *Atlas, 79, f. 2.*
"	*arcticum*	Bright. *Atlas, 79, f. 12, 13;* var. Californica, Grun., forma tetragona, Atlas, 81, f. 4; *var. Californica, Grun., Atlas, 79, f. 5, 6.*
"	*Montereyi*	Bright. Atlas, 94, f. 1, 2, 3.
"	*consimile*	Grun. V. H., 108, f. 2; *Atlas. 84, f. 13, 14.*
"	*quinquelobatum*	Grun. *Atlas, 79, f. 8.*
"	*parallelum*	Grev. *Atlas, 75, f. 3-5.*
"	*heteroporum*	Grun. V. H., 112, f. 2.

* Brun & Tempere give *R. epsilon* var. *longicornis.* Atlas, 183, f. 16; *vars. 13, 14, 15.*

Triceratium	*punctatum*	Bright. *Atlas, 76, f. 19, 20; M. J., 1856, p. 275, 17, f. 18;* (*Moebius, 9, f. 18*;
"	*Browneanum*	Grev. *T. M. S., 1861, p. 72, 8, f. 16.* (*Moebius, 38, f. 16*).
"	*Brightwellii*	West. *T. M. S., 1860, p. 149, 7, f. 6; vars, V. H., pl. 114.* (*Moebius, 34 f. 6*).
"	*inelegans*	Grev. Atlas, 81, f. 16.*
"	*elegans*	Grev. V. H., 109, f. 1; forma *pusilla*, V. H., 109, f. 3; *Atlas, 99, f. 10–13.*
"	*favus*	Ehr. *Atlas, 126, f. 5–7; 82, f. 13, 14; V. H., 107, f. 1–4.*
"	*cellulosum*	Grev. *Atlas, 95, f. 28–32.*
"	*trisulcum*	Bail. *Atlas, 78, f. 5–8; 112. f. 17, 18.*
"	*quadrangulare*	Grev. Atlas, 81, f. 3.
"	*antediluvianum*	Ehr. *V. H., 109, f. 4, 5.*
"	*subcornutum*	Grun. *Atlas, 99, f. 15–18.*
"	*constellatum*	Temp. & Br. *Diat. of Japan, p. 61, 6, f. 12.*
Xanthiopyxis	*umbonatus*	Grev. *T. M. S, 1866, 2, 1, f. 5;* (*Moebius, 70, f. 5*).

In addition to the preceding, which are on slides belonging to J. D. Möller and E. A. Schultze, the following species are figured as existing in the Santa Monica deposit:

Cosc. marginatus Ehr.	Atlas, 62, f. 5; 62, f. 7.
" " " var. *intermedia.*	" 62, f. 6.
" (*apiculatus* var.) Monicae Rattray.	" 63, f. 10.
Navicula demta A. S.	" 69, f. 34.
Triceratium receptum A. S.	" 81, f. 10.
Auliscus Grunowii A. S.	" 89, f. 7; 30, f. 14.
" *textilis* A. S.	" 89, f. 9.
" *incertus* A. S.	" 89, f. 18.
Eupodiscus Californicus Grun., forma *bioculata.*	" 89, f. 20; V. H., 118, f. 7.
Triceratium validum Grun.	" 94, f. 5.
Actinoptychus Thumii A. S.	" 102, f. 8.
Aulacodiscus Kinkeri A. S.	" 106, f. 4, 5.
Auliscus intestinalis A. S.	" 108, f. 2.
Campylodiscus trapezoidalis Deby.	Deby, pl. xiv., f. 72.
Coscinodiscus oculus iridis Ehr.	Atlas, 113 f. 20.
Coscinodiscus floridulus.	" 113, f. 16.
Stephanopyxis spinosissima Grun.	" 123, f. 18.
" ?	" 138, f. 14.
Cosc. incretus A. S.	" 139, f. 1.
Podosira variegata A. S.	" 140, f. 3.
Porpeia ?	" 142, f. 53–56, 57.

* Varieties: V. H., 110, f. 2, var. *araeophora* Grun.; V. H., 110, f. 3 var. *microphora* Grun.; V. H., 110, f. 4, 5, var. *Yucatensis* Grun.

Stictodiscus ?	"	147 f. 8.
Pseudauliscus sp. ?	"	149, f. 10.
Triceratium quadrinotatum A. S.	"	152, f. 31.
Actinoptychus spinulosus A. S.	"	153, f, 24.
Auliscus albidus Brun.	"	171, f. 3, 4; 171, f. 5.
" var. *boccata* Brun.		
Chaetoceros Monicae Grun.		V. H., 82 bis f. 4.
" *Californicus* Grun.		" 82 bis f. 8.
Pterotheca (*Pyxilla ?*) *subulata* Grun.		" 83 bis f. 6.
Stephanopyxis limbata Ehr.		" 83ter, f. 13, 14.
Zygoceros circinus Bail.		" 105, f. 13.
Tric. (*Odontella*) *Californicum* Grun.		" 108, f. 1.
Tric. (*Biddulphia*) *obliquum* Grun.		" 110, f. 11.
Actinoptychus ? pulchellus Grun.		" 123, f. 5.
" *? alienus* Grun., var. *Californica* Grun.		" 125, f. 10.
Coscinodiscus impressus Grun.		" 132, f. 5.

KEY TO REFERENCES.

V. H. = Van Heurck's Diatoms of Belgium.
Atlas = Schmidt's Atlas der Diatomaceen-kunde.
J. Q. C. = Journal Quekett Club.
M. J. = Quarterly Journal of Micros. Science.
T. M. S. = Transactions of Royal Microscopical Society. London.
Pritch. = Pritchard's History of the Infusoria. London, 1861.
Cast. = Diatomaceae of the Challenger Expedition by Count Castracane, 1887.
Deby = Analysis of the genus Campylodiscus. Sir Julian Deby.
Pant. = Beitrage zur kentniss der fossilen Bacillarian Ungarns.
Microgeologie = Ehrenberg. 1854.
Mic. Dict. = Micrographic Dictionary.
Donkin = History of British Diatomaceae. H. S. Donkin.
O'Meara = Report on the Irish Diatomaceae. Rev. E. O'Meara.
Diatoms of Japan = Brun & Tempere.
S. B. D. = Synopsis of the British Diatomaceae. Rev. Wm. Smith.
Moebius = A reproduction of plates of diatoms, by B. Moebius, principally from the Transactions of the Royal Microscopical Society.

No attempt has been made to give a complete reference of species, but to give references preferably to such works as are generally easiest of access. It will be noticed that most of them are referred either to Schmidt's Diatom Atlas, or to Van Heurck's synopsis. The references in roman mention Santa Monica as the locality. The references in italic indicate other localities.

Mycological Notes.

By Byron D. Halsted.

A Pineapple Mould.—Some specimens of decayed pineapple obtained in the market when sliced and placed in moist chambers in the laboratory developed in 36 hours a profuse and pure culture of a beautiful mould, which at first sight might have been mistaken for the common *Penicillium.* When microscopically examined, however, it was determined that it was a species of Chalara, and agrees quite closely with *Chalara paradoxa* (de Seynes) Sacc., described in Sylloge Fungorum, **10**: 595, and recorded for decaying pineapple in Paris, France.

The fungus as it appears upon the sliced pineapple may be quite completely divided into two portions. One consisting of hyaline perpendicular threads giving the mould in its early stages a frosty appearance not unlike that of *Peronospora* upon the leaf surface of their hosts, only much more magnified. Below and close to and even within the substance of the pineapple there soon follow a second spore development, which is also profuse, and on account of the prevailing olive color of the spores the whole appearance suggests, as before stated, that of the *Penicillium.*

The two forms of spores are very different, both as to their size and color and their method of formation. The first form of spore is usually hyaline, cylindrical, obtuse, and from 4–5 by 6–10 μ, while the second form is ovoid, oblong, olive brown and 8–9 to 16–18 μ.

The hyaline form of spore, which may be called the microspore, is formed endogenously and new spores are pushed out from the open end of a tip with considerable rapidity. The *Chalara* admits of easy cultivation in Van Teighem cells and the exogenous formation of these spores may be readily seen under higher powers of the microscope.

Before any spores have become separated from the long, straight tip of the filament there is a rounding off and a separation of the contents in the upper 10 μ of the tip. Following this there is a rupturing of the cell wall at the end of the hypha, and

shortly after a spore pushes its way out and becomes free. This is followed by the abjunction of masses of the hypha contents so that usually there may be seen from 3–5 of the double cross walls in the mother cell. One of the peculiarities noticed in this study of spore formation was the size of the first spore produced, it being uniformly, almost, exactly double that of the succeeding spores that were pushad out of the tube. The rapidity with which these spores are formed may be judged from the fact that a culture 18 hours old had on an average of 10 spores at the tip of each tube, and in many instances the number was as high as 23. The time required for the production of the hypha themselves is not known exactly in this case; but by actual timing of the production of some of the spores it is determined that from 20 to 30 minutes is all sufficient for the pushing out of a spore and the taking of its place at the mouth of the tube by its successor, and in some cases the time required is reduced from 15–20 minutes. It is not usual for these spores to form and remain in rows after they have escaped; but under the circumstances under which they were observed they formed little irregular groups at the ends of the mother tubes. While this form of spore production is not new it is nevertheless infrequent. My first personal knowledge of it was in connection with the study of the sweetpotato black rot fungus *Ceratocystis fimbriata* Ell. & Hals. The observation first being made with this species by Mr. Fairchild, who at the time was investigating the potato decay in my laboratory. This method of spore production is treated in a paper upon the *Ceratocystis* in the Journal of Mycology, Vol. 7, No. 1, and the endogenous form of the conidia is given on pages 5 and 6 with several references to previous articles bearing upon this peculiar formation of spores. A plate given in *Botanische Zeitung*, 1847, there referred to, shows very well this peculiar method of spore formation. However, I do not observe that any mention is made of the double size of the first spore, and there is no indication in the figure of adjunction of the spores within the tube. Dr. Zopf, in like manner in "Die Pilze," Figure 61, shows the same method of spore formation as taking place in *Thielavia basicola* Zopf.

The second form of spore has been studied, and there is not

the slightest indication of endogenous form. In this respect it differs materially from the macroconidia of the *Ceratocystis* which Mr. Fairchild demonstrated was produced in the same way by abjunction within the mother cell as above demonstrated for the microconidia. On the other hand, these spores are produced in chains of remarkable length and beauty in the Van Teighem cultures, there being sometimes 50 or more of the olive brown spores exceedingly uniform in size and holding together, even when the chains of spores have been distorted into extravagant shapes.

That these two forms of spores belong to the same plant was demonstrated beyond question, because sometimes from the same hypha there was given off upon the right hand a branch which developed endogenously the microconidia, while a few micromillimeters above or below and the opposite side a branch segmented into a chain of the macroconidia.

By taking portions of the *Chalara* from beneath the surface of the pineapple it was easily demonstrated that spores were produced from the subterranean filaments, which, while probably belonging to the macroconidia, differed from them both in shape and color, they being much longer and narrower, and of an almost pale blue color, besides these were formed at the tip of the hypha, and usually singly or, at the utmost, in chains of two or three spores. What was perhaps of more interest still is a form of spore agreeing in color quite closely with the macroconidia, but in size more nearly those of the hyaline microconidia. These were produced in long chains which easily fell apart and were associated with both the other above-mentioned forms. At first sight it would seem as if the hyaline, cylindrical, somewhat abrupt ended microconidia had become rounded and taken on a thicker cell wall and brown coloration; but the formation of these spores is by ordinary fission of the hypha, and agrees in that respect with the macroconidia.

It would seem, therefore, that in our *Chalara* there are three quite well defined kinds of spores, not counting the ones that are produced within the mass of the host, and as far as this goes it well bears out the specific name of the species, *paradoxa*. With a knowledge of the fact that associated with the two forms of co-

nidia in the *Ceratocystis* there is a pycnidia development, search was made for this structure in the pineapple cultures; but nothing of the sort has appeared. It is, however, true that the pycnidial development in the *Ceratocystis* was shy and not met with but a few times during the study of the sweetpotato black rot. Therefore realizing the great similarity between the microconidia in form and in method of production in the two genera and of the macroconidia in their structures, but not in their origin, one is inclined to continue the search for a pycnidial form of fungus in the case of *Chalara paradoxa*.

Notes upon Peach Root Galls.—After a study of the root knot or gall of the peach, chiefly from the standpoint of possible remedies, for the past two seasons, it may be well to put on record the fact that a fungus similar to the one noted above upon the pineapple is associated with the enlargements at the crown and elsewhere upon the roots of the peach.

The microconidia are hyaline and 10–15 by 3–4 μ, produced endogenously as for *Chalara* and *Ceratocystis*. The microconidia are olive-brown, oval 10–13 μ and formed by ordinary fission, and in that feature agree with *Chalara* and not with *Ceratocystis*. In its habitat it agrees with the latter in that both are soil fungi, the ceratocystis, as stated in the proceeding note, feeding upon the roots of the sweetpotato, and this one is upon the roots of the peach.

The fungus has been frequently met with upon crown and roots of seedling peaches while only a few weeks old and before any galls had started, and also at the end of the season, when galled roots were examined closely, the fungus being upon the surface of the knots and producing a dark color from the multitudes of dark macroconidia.

It remains to demonstrate, if possible, the causal connection of the fungus with the formation of the galls.

Natural Enemies of the Asparagus Rust.—The season of 1896 was the first one in which the genuine rust of the Asparagus (*Puccinia Asparagi* DC.) had been observed in this country outside of California. Since last year the disease has widened its range greatly and has become so severe that asparagus growers have full cause for alarm.

This fungus is one of the Uredineae having its three forms of spores produced upon the same host and, therefore, the student does not need to look elsewhere than upon the Asparagus for the aecidial, uredo, and teleutosporic forms of fruitage.

During the season now closing the cluster cups were first found upon specimens sent to the experiment station June 3d. An examination of these plants showed that the aecidial cups are in oval clusters. Frequently the cups were arranged as a border to the oval sorus and all within were spermagonia. Other sori are entirely spermagonial with no signs of aecidia. The spermagonia are easily distinguished by their small size and the watery appearance they give to the diseased spot.

The uredo form is frequently associated with the aecidia and its spores are produced in longitudinal slits in the epidermis in such abundance as to give the brownish color characteristic of the rusted plant. When associated with the clusters of aecidia the uredo sori are usually near to, but just outside of, the oval orange area devoted to cups and spermagonia.

The teleutospores when with the cluster of aecidia are quickly distinguished by the dark color due to the spores and their elevation above the level of the host. The sori of teleutospores occur anywhere in the aecidial cluster; thus, there may be one dark rift in the center of the cluster of cups or it may be close to the border, where it is often quite long.

It is seen from this that the asparagus rust appears in all of its forms almost simultaneously and often in the same disease spot. In short, several rust spots exhibited only spermagonia, others a mixture of these and the aecidia, while others had these two and the uredo or the teleutospore or both, so that a single diseased patch half the size of the little finger nail may contain all four forms. This matter of observation admits of the interpretation that all forms develop from the same unit of hyphae.

The aecidial form is the first one in the fungus life cycle, it being met with as early as June 3d, before stated, upon asparagus plants sent to the station from a center of the asparagus industry in the State. At that time the cutting of the beds was at its height and the rust was confined to the young plants that were allowed

to form "brush" and gain strength for cropping in future years. The first specimens of all were found upon plants that sprang up and were allowed to grow in land that had been in asparagus but rooted out and used for other crops. These vigorous volunteer shoots were covered with the aecidia, and doubtless produced a large crop of spores in readiness to inoculate the plants that came later in the season upon the regular beds.

It is interesting to note that while they were looked for throughout the season, and upon thousands upon thousands of plants, not an aecidium was ever met with except upon the volunteer plant, on those that starting early and unmolested produced brush long before the regular bed plants had shown above the surface. It would seem from this that the cluster cups need to form early in the season or they will not appear at all.

Associated with *Puccinia Asparagi* DC. there are at least two natural enemies in which the growers of asparagus may have some hope of assistance. One of these is associated particularly with the aecidial form and is the *Tubercularia perisicinia* Ditt., which is quickly recognized in the sorus by its purple color. This fungus is recorded for the Uredineae generally and it is a pleasure to find it in an economic rôle.

A second fungus, *Darluca filum* Cast., quite frequently infests the puccinia. It produces its mycelium in the rifts sometimes to the exclusion from view of all the spores of its host, transforming the sori bearing the orange powder into those filled with blackish, shining, minute, bead-like bodies. From these pycnidia the spores at maturity issue in fine white coils and frequently give the whole asparagus plant an appearance of being the victim of a downy mildew.

It is not known how much good this parasite may do, but judging from the present season it has a large field in which to operate.

October 28, 1897.

New southwestern Compositae.

By Edward L. Greene.

The following species, hitherto undescribed, occur in considerable fascicles of miscellaneous Compositae collected in various parts of New Mexico and Arizona by Mr. E. O. Wooton, and submitted to me for determination :

Coleosanthus Wootoni.

Pale with a short cinereous pubescence; leaves coriaceous, lanceolate, serrate, 2 inches long, longer than the internodes, spreading or recurved, short-petioled or subsessile; cymes subsessile in the axils of all the upper leaves and terminal; involucres about five lines high, little imbricated, the short outer bracts ovate, or oblong-ovate, the others oblong-linear, all finely striate and less pubescent than the leaves: achenes pubescent; pappus very fine, barely scabrous.

Organ Mountains, Dona Ana Co., New Mexico, Sept., 1892.

Erigeron condensatus (Eaton).

Erigeron concinnus von *condensatus* Eaton. Bot. King Exp. 151. 1871.

Perennial, subacaulescent, the subscapiform merely bracted monocephalous tufted stems only a few inches high; the densely tufted spatulate but very narrow leaves an inch long; bracts of the hemispherical involucre subequal, hispidulous; rays numerous, rather broad, white or pinkish; pappus of few and slender barbellulate bristles and an outer series of oblong paleae, these toothed or lacerate at the rather obtuse summit.

Species not uncommon in southern Nevada and adjacent Arizona, wearing much more the aspect of *E. pumilus* than of *E. concinnus;* very distinct from either in the character of its pappus. Mr. Wooten's fine specimens are from the base of Mt. San Francisco, Arizona.

Machaeranthera linearis.

Perennial, the stem 3 to 5 feet high, puberulent but not viscid, the branches leafy below, narrowly paniculate above; leaves linear, or the lowest lance-linear, 3 or 4 inches long, glabrous, 3-nerved, remotely and sharply dentate and scabrous-ciliolate; heads of the somewhat thyrsoid panicle numerous; broadly

turbinate involucre about 4 lines high, the multiserial closely imbricated bracts scarcely glandular, firm and chartaceous, with conspicuous short and appressed green tips; purple rays narrow and numerous, ½ inch long.

Sandy fields of the Mesilla Valley, New Mexico, flowering in autumn. A distinct and beautiful species.

GAILLARDIA MULTICEPS.

Less than a foot high, the numerous very leafy stems from an apparenty suffrutescent base, whitish and merely puberulent; the numerous leaves also puberulent, rather fleshy and deeply impressed-punctate, the lowest narrowly oblanceolate, obtuse, the others linear, all entire, mostly 2 or 3 inches long; peduncles short, slender; bracts of the involucre ovate, caudate-acuminate; rays yellow; teeth of the disk-corolla short and obtuse; ovaries very villous at base, more delicately pubescent above; pappus of elongated lanceolate paleae, and a short awn, but this quite surpassing the disk-corolla.

South of Woodruff, Arizona. A member of the group to which belong *G. spathulata* and G. PARRYI (*i. e., G. acaulis*, Gray, not Pursh).

The North American Species of Porella.

BY MARSHALL A. HOWE.

The name *Porella* first appears in the Historia Muscorum of Dillenius,* where it is applied to a genus of "Musci" from Pennsylvania, falling in his arrangement between *Lycopodium* and *Selaginoides*. In the generic characterization, the plant is described as bearing naked "antheraceous" capsules, without operculum or pedicel, dehiscing by several pores through the sides, and emitting a farinaceous powder. Following this is a diagnosis of the only species known to Dillenius, which we quote in the original, inasmuch as there is an opportunity for differences of opinion as to the exact translation in one or two particulars. His words are: "*Cui rami alterni, folia in nervo rigidiusculo alternatim opposita,*

* Historia Muscorum, 459. *pl. 68.* 1741.

obtuse pinnata, pellucida, viridia, altera parte convexa (vid. ram. e.) altera (vid. ramos reliquos) concava, qua parte capsulae ad pinnarum alas enascuntur parvae, oblongae, turgidae, exiguis aliquot ad basin squamis cinctae, tenui membrana constantes, quae luci obversae tres in singulo latere globulos ostentant, totidem foraminibus exilibus (duobus superius, reliquis per latera luscentibus) farinam fundentes; semina non comparent."

He further remarks that the plant revives when immersed in water, but in the dry state is contracted and convolute, not showing its structure; that his figure was made too black in the course of the work [presumably by the engraver]; and that his specimen was sent from Pennsylvania by Jo. Bartram, who had indicated that it grew in humid places.

The principal figure given by Dillenius represents fairly well what we now know as *Porella pinnata*, though rather too stout and with leaves too closely set; smaller accessory figures show the leaves in natural size and the "farinaceous capsules" "*aucta magnitudine.*" The latter are ellipsoidal or obovoid in form and exhibit a few perforations.

The identity of the plant thus described and figured long remained a puzzle to botanical writers. In the Species Plantarum of Linnaeus it appears under the Musci between the genera *Lycopodium* and *Sphagnum*. Linnaeus here bestows the specific name *pinnata*, quotes the "*Porella pinnis obtusis*" of Dillenius, refers to description and figure in the Historia Muscorum, gives the habitat as Pennsylvania, and states that he has never seen the plant and that Kalm has been unable to find it on its native soil. Mr. James Dickson was the first to detect that the *Porella* of Dillenius belonged to the Jungermaniaceae, and it may be worth while to quote his narrative of the circumstances, especially as M. Le Jolis has somewhat recently* given the impression that the discovery was wholly a chance affair and also that Dickson considered his *Jungermannia Porella* to be different from the *Porella* of Dillenius. Mr. Dickson's statements are as follows:†

"The genus *Porella*, first established by Dillenius and from

* Rev. Bryol. 19: 99. 1892.

† Trans. Linn. Soc. 3: 238. 1797.

him copied by Linnaeus, who never saw the plant, had long appeared to me to be very doubtful. I had, however, an opportunity, some time ago, of satisfying myself on this subject. I happened to receive some mosses as package to plants from America; and, upon examining them, found a *Jungermannia* and a *Splachnum* in fructification. I suspected the *Jungermannia* to be the same with the *Porella* of Dillenius; but this could not be ascertained without actually comparing the two specimens, which I had an opportunity of doing by the indulgence of Dr. Sibthorp, of Oxford, who permitted me to compare my mosses with Dillenius's original collection; and, upon the most careful examination, I found my *Jungermannia* to agree exactly with his *Porella*, but could find no fructification upon his specimens.

"As I have no doubt that my *Jungermannia* and his *Porella* are one and the same plant, I shall next endeavor to trace how Dillenius has fallen into this error; for the plant has exactly the habit of a *Jungermannia*. This was, probably, by receiving an imperfect specimen; as the vagina, when damaged either by the weather or by insects, after the tender flower had fallen off, would very much resemble the capsule which he has figured.

His figure of the plant is too much crowded with leaves; but in his original drawings, in the possession of Sir Joseph Banks, the leaves, so far as they are represented, are placed in the same manner as in the annexed figure. I shall now subjoin a description of it under the name of *Jungermannia porella*."

The subjoined description and "annexed figure," though somewhat incomplete according to modern standards, are very clearly based upon the plant of the eastern United States known as *Madotheca Porella* Nees, or, more recently, as *Porella pinnata* L.

In 1822 Dumortier established the genus *Madotheca*, based upon *Jungermannia platyphylla*, *J. thuja*, and *J. laevigata*. This name was taken up by Nees, who included in the genus the *Jungermannia Porella* of Dickson, and *Madotheca* came into general use as the appellation of this very natural generic group. Lindberg, in 1869, restored the Dillenian and Linnaean *Porella* and has been followed in this by Stephani (in some, at least, of his papers), Spruce, Massalongo, Underwood, Pearson, Evans, and others.

Schiffner,* however, though rejecting *Madotheca*, considers *Porella* of Linnaeus a *nomen nudum* and adopts *Bellincinia*, Raddi (1818), reinstated by Otto Kuntze.

Lindberg supposed the "antheraceous capsules" to be the ♂ branches, but we are inclined to accept Dickson's explanation of the Dillenian error. We are assisted to this view by detecting in the larger figure† given by Dillenius what we believe to be two or three "antheraceous capsules," which have the general appearance of perianths, and also by the form of the detached and enlarged "capsules." M. Le Jolis has somewhat lately, in a second‡ paper on the nomenclature of the Hepaticae, expressed the opinion that the figure in the Historia Muscorum would apply to a *Selaginella* as well as to one of the Jungermaniaceae and that it is easier for him to believe that a *Madotheca* has by some chance been fastened to the sheet previously occupied by the enigmatical *Porella* than that Dillenius could have made such blunders in interpreting its morphology and affinities. Against this view may be urged a portion of the Dillenian description concerning which M. Le Jolis, in his two elaborate papers, is silent. The "*Aquae immersa planta reviviscit, sicca contracta et convoluta est, structuram non monstrans*" is not applicable to any *Selaginella* of the eastern United States, but does apply in a significant way to the hepatic in question, a form of which, with leaves strongly convolute and stem subcircinate in drying, was given the specific name *involuta* by Hampe. Moreover, Dickson's statement that in the "original drawings in the possession of Sir William Banks, the leaves, so far as they are represented, are placed in the same manner as in the annexed figure" should have much weight. Neither M. Le Jolis nor any one else will question the meaning of Dickson's "annexed figure."

The objection that *Porella* is a *nomen nudum* with Linnaeus would apply equally well to *Targionia hypophylla* or *Blasia pusilla*, so far as any "specific phrase" in the Species Plantarum is con-

*Engler & Prantl, Nat. Pfl. Fam. 1: Abt. 3, 115. 1895.

†We have had access to the Edinburgh reprint of the Historia Muscorum (1811) and the abridged edition of 1763. Of these, the figures in the 1763 edition, in the Columbia University copy, at least, are much the clearer.

‡Mém. Soc. nation. Sci. nat. et Math. Cherbourg, 29: 142–147. 1894.

cerned. These had the good fortune to have been more accurately figured and described by the predecessors whom he quotes, to be confessedly European, and to be understood by his contemporaries. But now that there is not the least manner of doubt as to what the *Porella* of Dillenius and Linnaeus was, there seems to be no good reason why it should not stand as the name of the genus. Professor Underwood has this last summer examined the specimen in question in the Dillenian Herbarium at Oxford and adds his testimony to that of others to the effect that the plant is congeneric with the traditional *Jungermannia platyphylla* of Linnaeus and clearly identical specifically with the common hepatic of the eastern United States, known to Nees and his followers as *Madotheca Porella*.

PORELLA L. Sp. Pl. 2: 1106. 1753. Ex. Dill. Hist. Musc. 459. *pl. 68.* 1741.

Plants large, dark-green to yellowish-brown, mostly somewhat regularly bi- or tri-pinnate, rarely subsimple; root-hairs in tufts at the base of the underleaves, usually sparingly developed. Leaves very deeply 2-parted; the dorsal lobes large, incubous, obliquely orbicular-ovate to oblong, entire, repand or somewhat dentate; ventral lobes much smaller than the dorsal, sometimes nearly discrete, ovate, lingulate, oblong, linear, or lanceolate, nearly parallel with the stem, entire or toothed, margins plane or revolute. Underleaves large, somewhat similar in form to the ventral lobes but usually broader, entire or dentate, often long decurrent on both sides. Antheridia spherical, very short-stalked, single in the axils of saccate, densely imbricate, nearly equally bilobed opposite leaves, these connate with the underleaves and forming short, lateral, oval to linear-oblong spikes. Archegonia generally numerous, terminal on very short (most rarely a little elongated) lateral branches. Perianth oval to obovate, flattened dorso-ventrally toward the mouth, from a more or less obconical base, much longer than the bracts, two-lipped after elevation of the capsule or sometimes irregularly torn, mouth ciliate, dentate, or subentire. Bracts usually a single pair with a single bracteole in addition to the underleaf at the base of the branch, the latter underleaf united with the subtending cauline leaf and functioning as its ventral lobe, or free, leaving the cauline leaf unlobed. Capsule spherical to oval-oblong, on a short seta, yellowish-brown, opening, usually not quite to the base, by four often irregularly split valves; cell-walls of the

valves mostly with irregular nodulose thickenings. Elaters commonly 2-(1–3-) spiral; spores several times broader, more or less echinulate.

Key to the Species.

Stems subsimple or somewhat fasciculately branching, short, tumid; underleaves caudate-lacinulate at base. 8. *P. Bolanderi.*

Stems more or less regularly 1–3-pinnate.

Ventral lobes lingulate-oblong to linear-oblong, often somewhat falcate, closely appressed to stem or to dorsal lobes.

Dorsal lobes and underleaves entire, length of ventral lobes ⅓–⅔ the width of the dorsal. 1. *P. pinnata.*

Dorsal lobes entire, underleaves cillate-dentate at base, length of ventral lobes ½–⅔ the width of the dorsal. 2. *P. Swartziana.*

Leaves and underleaves repand-dentate. 3. *P. Wataugensis.*

Ventral lobes broadly ovate to oblong.

Usually shining.

Ventral lobes more or less spurred outwardly at base, mostly linguiform or ovate-oblong, margins plane or lightly recurved. 7. *P. Roellii.*

Ventral lobes regularly rounded outwardly at base, ovate, margin recurved. 6. *P. navicularis.*

Usually dull.

Rather flaccid, dorsal lobes subimbricate, ventral lobes long-decurrent, underleaves distant. 4. *P. rivularis.*

Somewhat rigid, dorsal lobes rather densely imbricate, ventral lobes scarcely decurrent, underleaves approximate or subimbricate. 5. *P. platyphylla.*

1. PORELLA PINNATA L. Sp. Pl. **2**: 1106. 1753.

Porella pinnis obtusis Dill. Hist. Musc. 459. *pl. 68.* 1741.

Jungermannia Porella Dicks. Trans. Linn. Soc. **3**: 239. 1797.

Jungermannia distans Schwein. Spec. Fl. Am. Sept. Crypt. 9. 1821.

Madotheca Porella Nees, Naturgesch. Eur. Leberm. **3**: 201. *p. p.* 1838.

Madotheca involuta Hampe, Lehm. & Lindenb. in Lehm. Pugillus, **7**: 10. 1838.

Madotheca Sullivantii Aust. Bull. Torr. Bot. Club, **3**: 15. 1872.

Dark or yellowish-green, rarely whitish, dull: stems usually bipinnate, sometimes tripinnate or subdichotomous, 4–11 cm. long, rather laxly matted; branches obtuse, often subfastigiate: dorsal lobes of leaves somewhat distant, contiguous, or slightly

imbricate, horizontal, commonly deflexed or convolute in drying, oblong or ovate, rounded-obtuse, 1–2.5 mm. × .65–1.7 mm., margins plane or the inferior slightly inflexed, entire, cells mostly with inconspicuous trigones; ventral lobes minute, closely appressed to the stem or to the dorsal lobes, very nearly or wholly discrete, lingulate-oblong or subfalcate, flat, with plane margins or slightly concave ventrally, obtuse, entire, not decurrent, .25–.68 mm. × .1–.27 mm., length usually equaling $\frac{1}{3}$–$\frac{2}{5}$ the width of the dorsal lobe; underleaves subquadrate or short-oblong, distant, appressed, scarcely decurrent, equaling stem in width or occasionally twice as broad, margins plane, entire, apex rounded or rarely repand-emarginate: dioicous: perianth obovate-pyriform, 4–5 times the length of the bracts, slightly crenulate at mouth; lobes of bracts entire or subrepand-crenulate; bracteole oblong, entire; spores 30–42 μ, papillate; elaters 2-(3–4-) spiral, 170–240 μ × 9–14 μ.

Exsicc. Drumm. Musc. Am. (Southern States) 167, 168 (both as *Jungermannia platyphylla*).

Musc. Allegh. 264.

Hep. Bor-Am. 92, 92[b], 93 (as *Madotheca involuta*), 94 (as *Madotheca Sullivantii*).

Hep. Am. 9, 115 (as *Porella involuta*), 175.

Can. Hep. 85.

On banks of shaded streams and on rocks and logs subject to overflow. Common in eastern North America from Nova Scotia to Louisiana. Owen Sound, Ontario (Macoun); Indiana (Underwood); Illinois (Schneck); Missouri (Demetrio); Arkansas (Coville); Cuba (Wright).

Type from Pennsylvania—in the Dillenian Herbarium at Oxford, England.

Usually collected in a sterile condition. *Jungermania distans* Schwein. is a form with rather remote leaves, found especially in the Southern States. *Madotheca involuta* Hampe differs from the typical form only in unimportant and wholly inconstant characters. The leaves are a little more imbricate, their inferior margins sometimes more inflexed; in drying, the leaves are closely wrapped about the stem or decurved and the branches often subcircinate. It produces sporogonia more freely than the type and evidently grows in somewhat drier situations. What is apparently

a portion of Hampe's original plant is to be found in Herb. Underwood. All the specimens from the Rocky Mountain region and the Pacific coast that have been referred to *Porella pinnata* belong, so far as we have seen them, to *Porella rivularis*.

2. PORELLA SWARTZIANA (Web.) Trevis. Mem. r. Ist. Lomb. III. 4: 407. 1877.

Jungermannia Swartziana Web. Prod. 18. 1815.

Madotheca Swartziana Lindenb. G. L. N. Syn. Hep. 271. 1845.

Sordid-green or slightly fulvous, dull, opaque: stems procumbent, irregularly pinnate or subbipinnate, 3–5 cm. long; branches obtuse, mostly short: dorsal lobes of leaves subimbricate, circumvolute when dry or spreading, ovate, obtuse, 1–1.7 mm. × .7–1.2 mm., entire or slightly repand, inferior margin decurved or subinflexed, occasionally a little undulate-crisped, the leaf-cells with prominent trigones; ventral lobes narrowly falcate or linear-oblong, erect, or commonly with the falcate apex introrse and appressed to the underleaves, flat with plane margins or somewhat concave ventrally, obtuse, rarely acuminate, entire or subrepand above, bearing at the base 1–3 cilia on the inner margin and sometimes a single cilium on the outer, not decurrent, .5–.85 mm. × .08–.17 mm., length ½–⅔ the width of the dorsal; underleaves oblong, erect-appressed, rarely exceeding stem in width, obtuse, truncate, or emarginate-repand, margins plane, entire above, ciliate-dentate at base, subdecurrent.

In low ravines, Opelousas, Louisiana (Rev. A. B. Langlois, no. 228 and, in part, no. 529).

The Louisiana plants agree very closely with a West Indian specimen of *P. Swartziana* in Herb. Underwood. Mexican specimens referred to this species differ in several respects. Weber supposed his original (which we have been unable to locate) to have been collected in Jamaica. We have seen no perianths or ♂ branches and these parts are not described by authors.

3. PORELLA WATAUGENSIS (Sulliv.) Underw. in herb.

Madotheca Porella var. ? Sulliv. Musc Allegh., no. 265. 1845.

Madotheca Wataugensis Sulliv. in A. Gray, Man. Bot. 700. 1856. *[2d ed.]

Similar to *Porella pinnata*, of which it is perhaps a variety—dif-

fering in being smaller and more delicate (dorsal lobes of leaves .85–1.2 mm. × .5–.85 mm.), and in the subrepand-dentate margins of dorsal and ventral lobes and underleaves.

Exsicc. Musc. Allegh. 265.

Adhering to decayed logs, bank of the Watauga River, near the base of Grandfather Mt., North Carolina (Sullivant). Collected but once. The ventral lobe often appears to be inserted a little lower upon the stem than the dorsal. The fascicles of rootlets mentioned by Sullivant as a distinguishing character are sometimes better developed in the true *Porella pinnata* than in this.

4. Porella rivularis (Nees) Trevis. Mem. r. Ist. Lomb. III. **4**: 407. 1877.

Madotheca rivularis Nees, Naturgesch. Eur. Leberm. **3**: 196. 1838.

Porella dentata Lindb. Act. Soc. Scien. Fenn. **9**: 342. 1869.

Dull, or very rarely a little polished, opaque, commonly dark green, sometimes yellowish, mostly soft and flaccid: stems irregularly pinnate or subdichotomous, 3–10 cm. long, prostrate or ascending, forming loose or more dense mats, branches somewhat obtuse, scarcely diminishing in width toward apex: dorsal lobes of leaves usually subimbricate or approximate, sometimes distant, rarely closely incubous, obliquely ovate to orbicular-ovate, rounded-obtuse, 1–2 mm. × .8–2 mm., entire or subdenticulate, flat or slightly concave beneath, only a little decurved at the apex, trigones mostly small; ventral lobes small, obliquely ovate, acute, .35–.7 mm. × .12–.4 mm., length $\frac{1}{3}$–$\frac{2}{5}$ the width of the dorsal, about one-half as broad as the underleaves, margins, especially the outer, for the most part broadly revolute, often giving the lobe a twisted appearance, long decurrent, usually dentate or subciliate at base internally and sometimes unindentate externally but scarcely spurred; underleaves distant, quadrate, orbicular to broadly ovate, about twice the width of the stem, apex rounded-obtuse, sometimes reflexed, margins repand-undulate, very long decurrent, the wing sometimes exceeding the free portion in length and usually acutely dentate or subciliate: dioicous: ♂ spikes oval to oblong, 1.5–2.5 mm. in length; ♀ branch short; ventral lobes of the single pair of bracts acute or subobtuse, entire or repand, the dorsal obtuse, bracteole ovate-linguiform, repand; perianth ovate, with lateral margins deflexed, deeply bilabiate, the lips subentire or repand-dentate, usually plane: spores 27–45 μ, papillate-echinulate; elaters 180–290 μ × 8–10 μ, rather obtuse, 2-(3-) spiral.

Exsicc. Hep. Bor-Am. 91 b.

Hep. Am. 96 (as *Porella platyphylla*), 150 (as *Porella Roellii*, var.).

Can. Hep. 99 (as *Porella dentata*).

On moist rocks, stones in streams, and bases of trees in densely shaded places. Widely distributed and extremely variable according to habitat. Apparently rare in eastern North America, but common on the Pacific Coast. Connecticut (Eaton); Ohio (Sullivant); Texas and New Mexico (Wright); Montana (R. S. Williams); Idaho (Leiberg); British Columbia (Macoun); Alaska (Miss Grace E. Cooley); California (Bolander, Parish, Howe).

Our determination is based upon the drawing (acccompanying G. & R. Hep. Eur. no. 371) of the original plant from the bed of the river Bober, near Hirschberg, Silesia, and upon European specimens and the descriptions of authors.

The name *dentata*, applied by Hartman in 1832 (Skand. Fl. 354, 2d ed.) to what he considered a variety of *Jungermania platyphylla* was taken up for the above species by Lindberg in 1869, but was abandoned by him ten years later without explanations. Hartman's description of his variety *dentata* is quite inadequate for its proper identification and as we have failed in our efforts to see his original specimens, if such exist, we prefer to adhere to the first name which was accompanied by an intelligible diagnosis.

5. Porella platyphylla (L.) Lindb. Act. Soc. Scien. Fenn. 9: 339. 1869.

Jungermannia platyphylla L. Sp. Pl. 2: 1134. 1753.

Jungermannia platyphylloidea Schwein. Spec. Fl. Am. Sept. Crypt. 9. 1821.

Madotheca platyphylla Dumort. Comm. Bot. 111. 1822.

Madotheca navicularis Nees, Naturgesch. Eur. Leberm. 3: 176. *p. p.* 1838.

Porella thuja Lindb. Act. Soc. Scien. Fenn. 9: 337. 1869.

Dull or most rarely with a slight lustre, opaque or a little pellucid, yellowish to very dark green, rather rigid: stems somewhat regularly or irregularly 1–3-pinnate, 3–8 cm. long, procumbent,

usually in compact mats, branches obtuse, very rarely subattenuate: dorsal lobes of leaves rather densely imbricate, appressed, or with the superior margin ascending or slightly reflexed, obliquely ovate to obliquely orbicular-ovate, rounded-obtuse, .85–2.1 mm. × .65–1.7 mm., apex more or less decurved, superior margin repand-dentate or subentire, the inferior sometimes a little undulate-crisped, cells at inferior basal angle scarcely smaller, trigones distinct; ventral lobes somewhat obliquely ovate to oblong, obtuse, rarely subacute, .4–1.2 mm. × .25–.85 mm., length about $\frac{3}{5}$ the width of the dorsal, nearly equaling underleaves in width or only one half as broad, margins, especially the outer, recurved, entire or with a single acute tooth at base, scarcely decurrent; underleaves approximate or subimbricate, semiorbicular to quadrate-oblong, rounded-obtuse, margins reflexed especially at apex, long-decurrent, sometimes repand or sparingly denticulate at base, otherwise entire: diocious: ♂ spikes oval to oblong, 1.2–3 mm. in length; ♀ branch short; dorsal lobes of bracts obtuse, more rarely acute, the ventral lobes usually acute, margins of both entire or denticulate; perianth oval, inflated ventrally along median line especially when young, narrowed above, the lips denticulate or subciliate, plane, or often lightly revolute, especially toward the lateral margins: capsule oval, light brown, the valves often irregularly split; spores 32–45 μ, echinulate, elaters 180–250 μ × 7–10 μ, 2-(1-) spiral.

Exsicc. Drumm. Musc. Am. (Southern States) 169.

Musc. Allegh. 263.

Hep. Bor-Am. 89, 90, and 91 c (as *Madotheca rivularis* var. ?).

Hep. Am. 29.

Can. Hep. 9.

On tree-trunks, logs, rocks, and soil. Very common in eastern, northern, southern and central North America. Wyoming (Mayhew); Idaho (Leiberg, no. 8, 1888); Vancouver Island, near Victoria (Macoun, May 15, 1893, on young fir trees, no. 29); Ontario (Mrs. Roy, Macoun); Quebec (Faxon); Nova Scotia (ex. herb. James, collector unknown).

Extremely variable. Most of the American specimens belong to *Porella thuja*, as defined by Lindberg, characterized by the somewhat regular pinnate branching, closely appressed obliquely rotund-ovate dorsal lobes, and oblong ventral lobes, the latter nearly or quite as broad as the underleaves. This appears to be

identical with the *Jungermannia platyphylloidea* of Schweinitz, of which we have seen authentic specimens both in his own herbarium preserved at Philadelphia and in that of Torrey at Columbia University. The more common European form of *P. platyphylla*, marked by irregular branching, yellower color, obliquely ovate dorsal tubes with the superior margins ascending or reflexed, and by the obliquely ovate ventral lobes, which are only about half as wide as the underleaves, is rare in America, but as such may be cited specimens collected by Mr. Faxon on Owl's Head, Canada (near Lake Memphremagog), June 27, 1885, and by Professor Underwood at West Goshen, Conn., July, 1887, and at Natural Bridge, Va., Sept., 1887. Transitional conditions occur so frequently that we believe nothing is gained by an attempt at separation.

6. PORELLA NAVICULARIS (Lehm. et Lindenb.) Lindb. Act. Soc. Scien. Fenn. **9**: 337. 1869.

Jungermannia navicularis Lehm. et Lindenb. in Lehm. Pugill. **6**: 38. 1834.

Madotheca navicularis Nees, G. L. N. Syn. Hep. 277, *p. p.* 1845.

Shining or more rarely dull, brownish-yellow, large: stems somewhat regularly bipinnate, 4–12 cm. long, procumbent-caespitose, or subpendulous with apices ascending when moist, branchlets gradually narrowed, subacute, convex on drying and slightly deflexed: dorsal lobes of leaves densely imbricate, appressed, for the most part closely wrapped about the stem when dry, obliquely orbicular-ovate to oblong-ovate, 1.2–2.5 mm. × 1–1.8 mm., rounded-obtuse, apex decurved, subcucullate, inferior margin slightly undulate-crisped, the superior decurrent, its wing sometimes laciniate-crispate, otherwise very entire, the inferior basal angle composed of numerous small thick-walled cells ¼–½ the diameter of the remainder, trigones conspicuous throughout; ventral lobes ovate, obtuse, most rarely subacute, regularly rounded outwardly at base, .5–1 mm. × .33–.75 mm., a little smaller than the underleaves, length somewhat more than ½ the width of the dorsal, margins entire, recurved, decurrent, apex often deflexed; underleaves approximate, quadrate-oblong, rounded-obtuse, margins entire, recurved, long-decurrent, apex occasionally deflexed: dioicous: ♂ branches oval to oblong, 1½–2½ mm. in length;

♀ branch short, lobes of the single pair of bracts minutely denticulate or entire, the ventral usually acute, the dorsal obtuse, bracteole wide; perianth broadly obovate from an obconic somewhat inflated base, scarcely narrowed above, deeply bilabiate, the lips at first subciliate-denticulate, later obsoletely crenulate-dentate or nearly entire, strongly revolute, giving perianth the appearance of being squarely or obliquely truncate: capsule ovoid, yellowish-brown, exserted by about its own length; spores 50–85 μ, echinulate, bright yellowish-green; elaters 275–325 μ × 9–10 μ, obtuse, 2-(3-) spiral.

Exsicc. Hep. Bor-Am. 91.

Hep. Am. 30.

Can. Hep. 7.

Common on trunks and branches of trees and more rarely on rocks throughout the Pacific Coast from California to Alaska; as far east as Idaho (Leiberg); Mexico (*fide* Gottsche).

The original specimens were collected by Menzies on the western coast of North America, exact locality unknown. The European plants referred by some authors to *Porella navicularis* probably all belong with *P. platyphylla* or *P. laevigata*. This species in a fertile condition can always be very easily distinguished from any simulating form of *P. platyphylla* by the broadly obovate perianth, scarcely narrowed at the mouth, and by the twice larger spores. When sterile, if more obvious characters fail, the numerous, small, thick-walled cells filling the inferior basal wing of the dorsal lobe are of importance; these are ¼–½ the diameter of the cells in the middle of the lobe while in *P. platyphylla* the cells are nearly of a uniform size throughout the lobe or slightly smaller at the basal margin.

7. Porella Roellii Steph. Bot. Centralb. **45**: 203. 1891.

Green or yellowish-brown, usually shining: stems procumbent, rather flaccid, densely depressed-caespitose, 4–8 cm. long, subdichotomous below, the primary branches for the most part simply and remotely pinnate, branchlets short, often attenuate-deflexed: dorsal lobes of leaves densely imbricate, appressed, obliquely ovate, patent-divergent, .85–1.7 mm. × .65–1.5 mm., apex narrowed, subtruncate, obtuse, or most rarely apiculate, inferior margin more or less undulate-crisped, the superior repand, cells at

basal angles slightly smaller, all with evident trigones; ventral lobes ovate, linguiform or ovate-oblong, usually much narrowed toward the obtuse or subacute apex, suberect or patent, scarcely connate with the dorsal, commonly about ½ as wide as the underleaves, length ⅔ the width of the dorsal, somewhat concave ventrally, margins plane or slightly recurved, a little decurrent, very rarely dentate above, more or less strongly spurred at the base, especially at the outer angle, the spur entire or dentate, rarely subciliate; underleaves approximate, ovate-linguiform, rounded-obtuse, the margins recurved, long-decurrent, entire or most rarely subdentate, the wings sometimes crisped: dioicous: ♂ spikes 1–2 mm. long; ♀ branch somewhat elongated, bearing 3–8 leaves (or "bracts") (usually 2 pairs) nearly similar to the cauline; inmost bracts a little larger, the lobes subacute, entire, repand-dentate, or sparingly denticulate, bracteole ovate, subentire or denticulate; perianth large, somewhat goblet-shaped or broadly obovate, undulate-concave ventrally, here and there inflated, scarcely narrowed or lobed at the wide truncate dentate mouth, the oral margins plane or slightly deflexed at the sides.

Exsicc. Can. Hep. 11 (as *Porella Bolanderi* var.).

Under shelving rocks and on moist shaded cliffs, rarely on tree-trunks. Washington: Kitchelos Lake (Roell, June 12, 1888); Olympia (Henderson, 1892, no. 2594). British Columbia (Macoun): Cascades, Yale (May 1875, also at Yale, May 17, 1889, no. 61); Mt. Benson, Vancouver Island, June 8, 1887; near Victoria (May 12, 1893, no. 7, and May 30, 1893, no. 63). Oregon (Pringle, 1881, no. 502, in part). California (Howe): Mill Valley (no. 1168) and Mt. Tamalpais (no. 1171), Marin Co.; near Cazadero (no. 1170), Sonoma Co.; Ukiah (no. 759) and Navarro (Miss Edith S. Byxbee), Mendocino Co.; Blue Lake (no. 994) and Deer Creek (nos. 1068 and 1073), Humboldt Co.; Hay Fork (no. 1109), Trinity Co.

Type from Kitchelos Lake, Washington (Roell, June 12, 1888)—in Herb. Stephani, Leipsic. Type duplicate in Herb. Underwood.

Porella Roellii is closely related to the forms of the European *P. laevigata* with obtuse dorsal lobes and subentire ventral lobes and underleaves, as represented, for example, in Carrington and Pearson's no. 275 Hep. Brit. Exsicc., from Scotland. This is

especially true of British Columbia specimens (Macoun : Cascades, Yale, May, 1875; no. 63, near Victoria, May 30, 1893), and of our no. 1068, from California. These latter differ, however, from *P. laevigata* in the smaller, narrower, more pointed, and more strongly calcarate ventral lobes, and in the usually more slender fronds. They are forms like these, we take it, that have been referred by Mr. Pearson * to *P. laevigata*, but in the predominating forms in Washington, Oregon and California the plant is much less suggestive of *P. laevigata*, and we prefer to maintain Stephani's species, and to associate with it the British Columbia specimens alluded to and our no. 1068, even though, as must be admitted, they make a near approach to certain conditions of the European plant. Perianths occur only on our no. 994 from Blue Lake, Humboldt Co., California. We have been unable to compare the perianths of *Porella laevigata*, inasmuch as these organs are uniformly wanting in the somewhat extended series of European specimens that we have been privileged to examine, but the perianth of *P. laevigata* is described by Nees † as ovate, inflated, and truncate-bi-trilobed, while in *P. Roellii* the perianth is broadly obovate or goblet-shaped, and scarcely lobed at the wide truncate mouth.

No. 150, Hep. Am. (issued as *Porella Roellii*, var.) belongs with *P. rivularis*, as is evidenced by the form of the ventral lobes and underleaves, the short ♀ branches, the characters of the perianth, etc.

Professor Macoun's specimen from Yale, British Columbia, May, 1875, was labeled "*Madotheca Macounii* n. sp." and "*M. laevigata*, var. *integrifolia*," by Austin *in herb.*

8. Porella Bolanderi (Aust.) Pearson, List. Can. Hep. 7. 1890.

[excluding specimens cited (?)]

Madotheca Bolanderi Aust. Bull. Torr. Bot. Club, 3 : 14. 1872.

Dark- or yellowish-green, dull : stems 1½–6 cm. long, subsimple or with a few somewhat fasciculately disposed obtuse tumid branches, often subpendulous, more or less vaulted or flexuous when dry : dorsal lobes of leaves densely imbricate, appressed or subsquarrose, dimidiate-ovate to oblong, 1.5–2.9 mm. × .67–1.8 mm., sometimes considerably narrowed toward the obtuse apex,

* List of Canadian Hepaticae, 7. 1890.

† Naturgesch. Eur. Leberm. 3 : 165. 1838.

slightly decurved when moist, circumvolute-deflexed in drying, rather distinctly margined by somewhat inflated subrectangular cells, the inferior margin more or less undulate, often narrowly inflexed, the superior repand or here and there caudate-dentate, the base long drawn out and projecting beyond the stem, trigones small; ventral lobes and underleaves approximate or more often imbricate, sometimes entirely concealing the stem; ventral lobes ovate-lanceolate to linear-lanceolate, rarely almost subulate, acute or occasionally somewhat obtuse, subfalcate, canaliculate, slightly twisted, long-decurrent, nearly discrete, .4–1 mm. × .08–.4 mm., about ½ as wide as the underleaves, length $\frac{2}{5}$–$\frac{3}{5}$ the width of the dorsal, undulate-repand above, sparingly caudate-lacinulate on inner side at base, often also on the outer; underleaves ovate-lingulate to oblong, a little wider than the stem, apex obtuse, subacute, rarely emarginate or slightly cleft, often deflexed, margins plane or recurved, undulate-repand, long-decurrent, the wings with commonly 2 or 3 cauda-like laciniae on either side toward the base: dioicous: ♂ spikes oblong to almost linear, 2–4 mm. in length; ♀ branch short; dorsal lobes of bracts subobtuse or acute, the ventral acute or often subulate-pointed, margins of both subentire or denticulate above, ciliate-caudate at base, bracteole large, ovate, usually acute, denticulate above, caudate-lacinulate below; underleaf subtending ♀ branch acutely emarginate or bifid; perianth broadly ovate from a shortly obconic base, somewhat compressed, lightly undulate-plicate dorsally, often furnished ventrally with 2 or three rarely winged carinae, narrowed at the ciliate, subtruncate, deeply bilabiate mouth: capsule oval or oval-oblong, exserted by about its own length; spores 29–40 μ, minutely echinulate; elaters 180–310 μ × 10–12 μ, 2-(3-) spiral.

Exsicc. Hep. Am. 31.

On stones, under shelving rocks, and on the bark of living trees, especially of *Quercus agrifolia*. California, apparently throughout the state (Bolander, Underwood, McClatchie, Howe).

Type in Herb. Pearson, Knutsford, Cheshire, England. We have seen no specimens of *Porella Bolanderi* from any station outside of California. Can. Hep. no. 10 (distributed as *P. Bolanderi*) is, so far as we have seen it, *Porella rivularis*—in one pocket mixed with *P. navicularis*. Can. Hep. no. 11 (issued as *Porella Bolanderi* var.), from Mt. Benson, Vancouver Island, is *Porella Roellii* Stephani.

In moist, densely shaded places, *Porella Bolanderi* assumes a more lax, flaccid habit, resembling certain forms of *P. rivularis*.

Such conditions, however, when the characteristic ciliate perianths are wanting, can usually be distinguished from any state of *P. rivularis* by the more oblong, more distinctly marginate, dorsal leaf-lobes, and by the longer and narrower ventral lobes and underleaves, which are more pronouncedly caudate at the base.

The above revision is based, outside of our own collcctions in California, chiefly upon the rich representation of this genus in the herbarium of Professor Underwood, and upon the specimens in the herbarium of Columbia University. We further gratefully acknowledge our indebtedness to the Philadelphia Academy of Sciences, for the loan of the Schweinitz collection; to Dr. A. W. Evans for the privilege of examining specimens in his own herbarium and that of Yale University, and to W. H. Pearson, Esq., of Knutsford, Cheshire, England, for the loan of the type of *Porella Bolanderi*.

COLUMBIA UNIVERSITY, DEPARTMENT OF BOTANY,
November 13, 1897.

A new Species of Wild Ginger hitherto confounded with Asarum Canadense L.

BY EUGENE P. BICKNELL.

(PLATES 316, 317.)

It has certainly much significance in its bearing on the study of our common flora that a plant so noteworthy as the familiar wild ginger, and supposedly so well understood, should now reveal itself as embracing two perfectly distinct species. Both plants are common and widely distributed, but they are so much alike in general appearance that it is scarcely a matter of surprise that they have held their secret so long. Agreeing in main features throughout, they share the same general form of rootstock, leaf and flower, are similar in habit of growth, and bloom at the same time. The differences between them are, in fact, no greater than might fairly measure the variation of a single species, and that they are of higher import has been learned only by careful field study continued through several seasons.

While the determination of dried specimens is not always easy, living plants may always be distinguished instantly by a glance at the flowers, and further comparative study cannot fail to lead to their recognition as beautifully similar yet beautifully distinct species.

The most obvious differences between these plants reside in the flowers. In one the calyx-lobes are spreading and revolute passing gradually into a slender upcurved acumination, and the interior of the tube is purple nearly down to the base; in the other species the calyx-tube is white within and the flat and reflexed lobes are abruptly acuminate at the apex into a straight obtuse point.

Fortunately there need be no uncertainty as to which one of these plants should bear the name *Asarum Canadense* L. Although the description in Species Plantarum is diagnostic of neither species the citations there given establish conclusively that the Linnaean plant was the one with gradually acuminate calyx-lobes.

The following references enter into the foundation of the Linnean species:

"Gron. Virg. 52.

Moris. hist. 3. p. 511. s. 13. *t.* 7. *f.* 4.

Corn. Can. 24, t. 25."

The specimen of Gronovius is perhaps no longer in existence, nor is it of any great consequence in view of the sufficiency of the remaining citations. I am indebted to Mr. Edmund G. Baker for the information that this particular type is not to be found among the Gronovian specimens in the British Museum. I have also to thank Mr. Baker for a tracing of the illustration in the rare work of Morison. This figure proves to be merely a reduced copy of the plate of "*Asaron Canadense*" in Cornuti's "Canadensium Plantarum," published in 1635, which is a crude but quite unmistakable illustration of the plant with gradually acuminate calyx-lobes, establishing perfectly the significance of the Linnaean name.

The synonomy of this plant is as follows:

ASARUM CANADENSE L. Sp. Pl. 1: 442. 1753.

A. Carolinianum Walter, Fl. Car. 143. 1788.

A. latifolium Salis. Prodr. 344. 1796.

A. Canadense β *obtusum* Muhl. Cat. 1813.

A. acuminatum Muhl. Cat. ed. 2. *Nomen nudum.* 1818.

A. parviflorum Raf. New Fl. 2 : 20. 1836.

A. furcatum Raf. l. c.

A. medium Raf. l. c.

"*A. villosum* Muhl. Cat." vide Duchartre in DC. Prodr. **15** : 424. 1864.

It is quite possible that one or more of these names had at least partial reference to the neglected species here discussed, but there is nothing in the definition of any one of them to justify its present revival.

The three names of Rafinesque are together passed into the synonomy of *A. Canadense* L. by this remark of Rafinesque himself in connection with his descriptions: "The *A. Canadense* differs from all these by smooth reniform leaves, calyx reflected, etc." These words evidently refer to our new species, and show that Rafinesque really knew both of our plants but made the mistake of renaming true *Canadense*, assuming that to be the one which was undescribed.

It appears probable that Muhlenberg earlier fell into the same error. His *nomen nudum*, *Asarum acuminatum*, may well have referred to true *Canadense*, allowing the inference that his further catalogue names, *A. Canadense* and its variety *obtusum*, really stood for the undescribed plant. This, however, is only conjecture, and as the leaves of true *Canadense* are either acute or obtuse no warrant it found for now taking up Muhlenberg's varietal name. There is little doubt that Salisbury's name, *Asarum latifolium*, is a synomym. The description of this plant as quoted by Willdenow (I have not seen the original publication) correlates it sufficiently with the Linnean species.

Walter's plant was doubtless based on a malformed example of one or the other of our species, both of which sometimes occur with "*folius* * * *emarginatus*," apparently the result of accident to the growing bud; nothing in Walter's description is distinctive of either plant. It would thus appear that there is no sufficient evidence that the new plant has ever had a name. It may now there-

fore be called *Asarum reflexum* in allusion to its characteristically reflected calyx-lobes.

The two plants agree in the following characters:

Rootstock horizontal, branching, jointed, each internode marking one season's growth, and throwing out long fibrous roots; leaves two, rising on long, erect, pubescent petioles from the ends of the new shoots, appearing opposite by suppression of the axis; leaf-blades reniform, the innermost in the bud commonly more acute than the outer one and often with a shallow indentation on either side giving it a slightly three-lobed outline; new shoots provided with three large, membranous, alternate scale-like bracts subtending minute axillary buds which may or may not develop into branches; flower solitary, peduncled in the fork of the petioles; calyx coherent below with the six-celled, many-seeded ovary, campanulate, three-parted with spreading limb, pubescent, the tips of the valvate sepals inflexed in the bud; stamens twelve, alternating in a longer and shorter series subequal with the united styles and inserted at the base of the column, at first recurved against the surface of the ovary, each series finally rising in turn against the column, the longer series first; filaments longer than the adnate, extrorse anthers, the connective terminating in a subulate projection; styles coherent in a column 6-lobed at the apex, separating and spreading at maturity, the cells of the ovary opening loculicidally; capsule bursting irregularly and dissipating in loose mealy tissue; seeds ovoid, prominently carunculate.

Asarum Canadense L.

Rootstock short, stout, 2.5–15 cm. long, 6–10 mm. thick, short-jointed, constricted at the nodes, its branches short, spreading or reflexed, sub-opposite, often approximate, usually developed only from joints of the preceding season on rhizomes of several years' growth; joints or internodes puberulent, 1.5–4 cm. long, the lower end of each joint contracted, and narrowly scarred from the insertions of the fallen bracts; roots numerous, mostly clustered at the lower ends of the internodes, often densely matted together; bracts broadly ovate, more or less puberulent, obtuse, approximate or overlapping, finally loosely spreading and deciduous; leaves commonly reniform-cordate, little, if at all, broader than long, with a deep, often partly closed sinus, acute or obtuse at the apex, rugose-veiny, the hirsutulous-puberulent upper surface with a satiny lustre, the lower surface somewhat shining beneath the close pubescence of minute white hairs; petioles 3–6 mm. thick, at first canescent throughout or densely white-pubescent with short, spreading or slightly reflexed hairs, becoming

more loosely pubescent, or puberulent, often with cinereous or somewhat rusty hairs; leaves at first 4–7 cm. broad on petioles, 2.5–5 cm. long, later becoming much larger, and reaching an extreme size of 21 cm. wide by 19 cm. long on petioles 32 cm. in length; flowers at anthesis usually reclining on the ground on short, spreading or declined peduncles, at maturity often erect or raised on ascending or erect peduncles 13–40 mm. long; freshly opened flower about 1.3 cm. long, the tube of the calyx about twice the length of the ovary, when fully grown, often 2.5 cm. long and 12–15 mm. wide, the ovary and tube of about equal length; upper half of the erect calyx-lobes spreading or ascending, somewhat crescentic in outline with revolute margins which pass into an upcurved tubular acumination 4–8 mm. long; spread of the flower across the acuminate lobes 2–3.8 cm., the opening of the tube circular; rudimentary petals almost always present as filiform bodies 2–4 mm. long, rising from the surface of the ovary opposite the sinuses of the calyx; peduncles and calyx villous-pubescent, or in age nearly canescent, the spreading purple segments densely erect-puberulent with thickish purple hairs, or sometimes greenish and nearly glabrous, probably through abrasion; inflexed tips of the calyx-lobes in the bud coherent and extending down to the tip of the column; exterior of the calyx hexagonal, the six faces plane, dull-whitish to greenish-purple, the interior of the tube deep purple more than half-way down to the white base which surrounds a hexagonal purple band enclosing the stamens; surface of ovary at maturity somewhat pyramidal, rising into the short, thick terete column which is 2–4 mm. high and rather deeply six-lobed at the summit; stigmas prominent, at anthesis pale pink and densely spiculate; stamens dull pinkish-purple, anthers dull pink; prolonged tips of the filaments slender-subulate, from one to three times the length of the anther in the longer series of stamens. (Plate 316.)

Specimens examined indicate a range from Quebec and Ontario to western Massachusetts, southeastern New York and Pennsylvania and southward in the Alleghanies to Virginia. Mr. Pollard tells me that the species is frequent about Washington.

The plant grows in rich hilly woods often in rocky situations. It begins to flower at New York from the third week in April to the first week in May; in some seasons flowers are still to be found at the end of June.

After the flower has fallen the bud for the next season's growth appears at one side of the cicatrix left by the peduncle, or

sometimes an opposite bud also forms, but fails to develop. In late summer the primary bud is well developed and encloses the next season's flower and leaves perfectly formed.

Two instances of dimerous flowers have been observed, and it is recorded by Decainse (D.C. Prod. **15**: 424), that tetramerous flowers are not rare. Occasionally the plant develops undersized leaves which are oblong with rounded or slightly cordate base, or even decurrent into the petiole.

ASARUM REFLEXUM n. sp.

Rootstock slender and elongated, 1.–4.5 dm. long, about 4 mm. thick, or shorter and stouter in one form of the plant, its branches usually slender and remotely alternate, often elongated and again branched; internodes 4–10 cm. long, little if at all contracted at the joints, glabrous, the bract scars prominent, the uppermost distant; roots fewer and more slender than in *Canadense*, more scattered, or borne mainly at the forward ends of the internodes; bracts narrower and more acute than in *Canadense*, less pubescent, more or less separated or distant, early spreading and deciduous; leaves broader than long, varying from reniform and lunate-reniform with a shallow open sinus to suborbicular with a deep sinus, obtusely pointed, broadly acute or rounded at the apex, darker green, thinner and less rugose than in *Canadense*, commonly nearly glabrous above and with a satiny lustre, somewhat shining on the lower surface through the thin or sometimes close pubescence of minute hairs; a common size of the leaves is 10 cm. wide, by 8 cm. or less long on petioles 1.5 dm. long, an extreme size 1.7 dm. wide on petioles 2. dm. long; at vernation the petioles are relatively longer than in *Canadense*; petioles slender, 3–4 mm. thick, loosely or thinly tortuose-pubescent with slightly longer and softer hairs than in *Canadense*, somewhat shining on the outer surface and mostly glabrous towards the base except along the villous-pubescent inner margins, often nearly glabrous throughout in age; flowers smaller than those of *Canadense*, 8–20 mm. long, 7–14 mm. wide, spreading 16–26 mm. across the extended lobes, the tube 4–8 mm. high, at anthesis on slender ascending or erect peduncles, at maturity mostly spreading or reclined on peduncles 3.8–5 cm. long; the ovary from the first about the length of the calyx-tube; limb early reflexed, in age sometimes ascending, the lobes 8–10 mm. long, about the length of the tube, flattish and rather brittle, triangular in outline, ending abruptly in a straight obtuse point 2–4 mm. long; opening of the flower commonly more or less triangular; rudimentary petals

usually wanting; peduncle and calyx densely cottony-villose, much less so in age, the outer surface of the sepals loosely pilose-pubescent, the reflected brownish-purple segments somewhat shining and minutely puberulent with dull purple hairs and faintly parallel-veined; inflexed tips of the sepals in the mature bud extending only half-way to tip of column; interior of tube white or greenish-white below the rim, the disk surrounded by a purple band as in *Canadense*; exterior of flower white to greenish-purple, the hexagonal base with prominent rounded angles and intervening depressions; surface of ovary plane or nearly so; column slender, columnar, longer than in *Canadense*, 4–7 mm. long, strongly grooved to receive the longer series of stamens, the stigmas greenish and purple, rather smaller than in *Canadense* and often merely granulose; stamens deeper purple than in *Canadense* with shorter anthers, the filaments slightly longer and closer to the column, their tips shorter and less attenuate, often less than half the length of the anther. (Plate 317.)

Rich low woods along streams or river valleys, often forming extensive beds; more rarely in upland woods; flowering at the same time as *A. Canadense*. Southeastern New York, and doubtless Connecticut, to Iowa, south to the mountains of North Carolina, Missouri and Kansas.

Aside from the notable differences of the flowers which has already been emphasized, *Asarum reflexum* differs generally from *A. Canadense* in more slender habit, sparser pubescence of rather longer hairs, and more broadly reniform leaves. The plant is also much less aromatic.

The typical form of the plant which occurs in rich woodland along the banks of streams and rivers is particularly characterized by slender elongated rootstocks loosely interlaced on and near the surface of the ground, long internodes, and broad leaf-blades with divergent sides and wide openly graduated sinus. The occasional form of drier upland woods is rather stouter and more pubescent with shorter internodes and rootstocks, the leaf-blades commonly suborbicular and more or less rounded at the apex, the sides parallel or approaching rather than divergent and rounding into or even overlapping at the sinus, which is very wide at the insertion of the petiole; the opening of the flower is nearly circular instead of more or less triangular as in the type.

This plant has been especially studied in Van Cortlandt Park, New York City, where the typical form is found in abundance in the woodland along Tibbit's Brook and the upland form also occurs. Through the kindness of Prof. Trelease I have been enabled also to examine fresh material from the vicinity of St. Louis.

A single plant bearing a 4-merous flower was collected in Van Cortlandt Park.

Type material from Van Cortlandt Park will be deposited in the Herbaria of Columbia University and the New York Botanical Garden, the Gray Herbarium and the Herbaria of the Missouri Botanical Garden and the U. S. Department of Agriculture.

The foregoing description of *Asarum reflexum* has been drawn to cover only the typical plant and its causal variations. It would appear that a geographical variety must also be recognized. Living specimens were sent to me in May, 1897, collected on the bank of the Desplaines river at Maywood, Illinois, near Chicago, which, though essentially like the type, show characters apparently never developed by the more eastern plant. As in the case of *A. reflexum* and *A. Canadense* here again the most evident differences are found in the flower, which shows especially a notable elongation of the strongly reflexed calyx-segments as denoted in the accompanying illustration (Plate II., a, b).

The variety may be characterized as follows:

ASARUM REFLEXUM AMBIGUUM n. var.

Slender, the leaf-blades short and very broad with a deep wide sinus and mostly abruptly pointed at the apex, the lower surface rather densely, even softly, pubescent; flowers often longer and narrower than in *reflexum;* exterior of calyx nearly white, very woolly tomentose, the tube 8–10 mm. long, the reflexed lobes longer and narrower than in the type with much longer points, 8–9 mm. wide at the base, 12–17 mm. long, the straight slender points 4–8 mm. long, sometimes extending back to the base of the calyx and closely appressed against it; surface of reflexed lobes light brownish-red, distinctly parallel-veined, glabrate; column short, 3–4 mm. high; hexagonal band on surface of ovary narrower than in the type and of a bright purplish-red color.

In one specimen the calyx-lobes are almost pointless, but are longer than normally and evenly graduated to the apex.

The type will be deposited in the Herbarium of the New York Botanical Garden.

A comparative histological study of *Asarum reflexum* and *Asarum Canadense* has been undertaken by Dr. Albert Schneider, now of Northwestern University, the results of which will shortly be published. Dr. Schneider tells me that his preliminary examination shows that the histological elements are structually almost identical in the two plants, but that their arrangement and relative abundance are strikingly different. In *A. reflexum* the annular and spiral vessels are much more numerous than in *Canadense*, in which tracheids predominate. The usual reaction tests for *Canadense* meet with a weaker response from *reflexum* very much as with *A. Europaeum*. Dr. Schneider is of the opinion that the new plant should probably be excluded from the Pharmacopaeia owing to the apparently deficient medical principle. A careful chemical analysis is necessary to decide this.

The drawings are reduced in engraving to about two-thirds natural size.

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* The proofs of this article came to hand a few days after the receipt of a privately printed paper by Mr. W. W. Ashe, entitled "The Genus Asarum in Eastern America," in which is described *Asarum Canadense acuminatum* nov. var. The points of distinction indicated for this new variety are "Calyx-lobes gradually acuminate, longer than the tube," *Canadense* itself being credited with calyx-lobes "as long as or somewhat longer that the tube, abruptly acuminate."

As already shown in the present paper, the one of our two common eastern plants having the longer more gradually acuminate calyx-segments is the authentic *Asarum Canadense* of Linnaeus, and the very plant, in all probability, to which Muhlenberg afterwards applied the name *acuminatum*, now again used by Mr. Ashe.

There occurs in Minnesota a form of *Asarum* having very long, slenderly acuminate calyx-lobes and apparently occupying a position between *A. Canadense* and *A. caudatum*. Having seen but a single specimen of this plant allusion to it was deferred until further material should be forthcoming. Minnesota is one of the localities named by Mr. Ashe for his new variety, which may very possibly represent a plant not found at all farther east. The matter cannot be followed to a conclusion at the present time, when this paper goes at once to press.

Botanical Notes.

A correction. In some way, a mistake was allowed to pass in my article in the October BULLETIN on "Plants of New Mexico." On page 478 the reading is "Edwinia Wrightii," when it should be as follows:

FENDLERA WRIGHTII (Engelm. & Gray).

Fendlera rupicola var. *Wrightii* Engelm. & Gray, Pl. Wright. 1: 77. *pl. 5. f. 2.* 1852.

A. A. HELLER.

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